# LUMBAR PLEXUS.

- FIRST LUMBAR.
- SECOND LUMBAR.
- THIRD LUMBAR.
- FOURTH LUMBAR.

**LUMBAR PLEXUS.**

- ILIO-HYPOGASTRIC.
  - Iliac. — CUTANEOUS.
  - Hypogastric.
    - MUSCULAR.—Rectus Abdominis.
    - CUTANEOUS.
- ILIO-INGUINAL.
  - Communicating. — To ilio-hypogastric.
  - Muscular. — Internal oblique.
  - Cutaneous.
- GENITO-CRURAL.
  - Genital.
    - VASCULAR.
    - MUSCULAR.—Cremaster.
  - Crural.
    - VASCULAR.
    - CUTANEOUS.
    - COMMUNICATING.—To middle cutaneous.
- EXTERNAL CUTANEOUS.
  - Anterior.
    - CUTANEOUS.
    - COMMUNICATING.—To long saphenous.
  - Posterior. — CUTANEOUS.
- OBTURATOR.
  - Anterior.
    - ARTICULAR.
    - MUSCULAR.
      - Adductor Longus.
      - " Brevis.
      - Gracilis.
      - Pectinius.
    - COMMUMICATING.
      - To accessory obturator.
      - To internal cutaneous.
      - " long saphenous.
    - VASCULAR.
  - Posterior.
    - MUSCULAR.
      - Obturator Externus.
      - Adductor Magnus.
      - " Brevis.
    - ARTICULAR.—*Vascular.*
- ACCESSORY OBTURATOR
  - Muscular. — Pectineus.
  - Articular.
  - Cutaneous.
  - Communicating. — To anterior branch of obturator.
- ANTERIOR CRURAL.
  - Muscular. — Iliacus.
  - Vascular.
  - Cutaneous.
    - MIDDLE CUTANEOUS.
      - *Muscular.* — Sartorius.
      - *External.*
        - *cutaneous.*
        - *communicating.*
          - To crural br. of genito-crural.
          - " external cutaneous.
      - *Internal.*
        - *cutaneous.*
        - *communicating.*— To internal cutaneous.
    - INTERNAL CUTANEOUS.
      - *Muscular.* — Sartorius.
      - *Cutaneous.*
      - *Anterior.*
        - *cutaneous.*
        - *communicating.*— To long saphenous.
      - *Internal.*
        - *cutaneous.*
        - *communicating.*
          - To long saphenous.
          - " obturator.
    - LONG OR INTERNAL SAPHENOUS.
      - *Cutaneous.*
      - *Communicating.*
        - To obturator
        - " internal cutaneous.
      - *Nervus Cutaneous Patellae.*
        - *cutaneous.*
        - *communicating.*
          - To ant. br. of int. cut.
          - " long saphenous
          - " middle cutaneous.
          - " external "
          - (*Plexus Patellae.*)
  - Muscular.
    - Pectineus.
    - Rectus Femoris.
    - Vastus Externus.—*Articular.*
    - " Intermus.— "
    - Crureus.
    - Sub-crureus.

## LUMBO-SACRAL CORD.

- BRANCH OF FOURTH LUMBAR AND THE FIFTH LUMBAR.

LUMBO-SACRAL CORD.

- Superior Gluteal
  - SUPERIOR.—*Mucsular.*
    - Gluteus Medius.
    - " Minimus.
  - INFERIOR.—*Muscular.*
    - " Medius.
    - " Minimus.
    - Tensor Vaginae Femoris.
- MAIN PART OF CORD TO JOIN THE 1ST SACRAL.

Accompanying THE SPINAL NERVES, by A. H. P. Leuf, M. D. 

# THE DORSAL NERVES.

- THORACIC NERVES.
  - POSTERIOR DIVISION.
    - EXTERNAL BRANCHES.
      - *Upper Six—muscular.*
        - Transversalis Colli.
        - Longissimus Dorsi.
        - Trachelo-Mastoid.
        - Levatores Costarum.
        - Sacro-Lumbalis.
        - Accessorius.
      - *Lower Six.*
        - *muscular.*
          - Transversalis Colli.
          - Longissimus Dorsi.
          - Trachelo-Mastoid.
          - Levatores Costarum.
          - Sacro-Lumbalis.
          - Accessorius.
        - *cutaneous.*
    - INTERNAL BRANCHES.
      - *Upper Six.*
        - *muscular.*
        - *cutaneous.*
        - Semispinalis Dorsi.
        - Multifidus Spinae.
      - *Lower Six —muscular.*
        - Semispinalis Dorsi.
        - Multifidus Spinae.
  - ANTERIOR DIVISION OR INTERCOSTALS.
    - UPPER SIX OR THORACIC.
      - *Communicating.* —To sympathetic.
      - *Muscular.*
        - External Intercostals.
        - Internal "
        - Triangularis Sterni.
      - *Lateral Cutaneous.*
        - *anterior.*
        - *posterior.*
      - *Anterior Cutaneous.*
        - *muscular*—Pectoralis Major.
        - *cutaneous.*
    - LOWER SIX OR THORACICO-ABDOMINAL.
      - *Communicating.* —To sympathetic.
      - *Muscular.*
        - External Intercostals.
        - Internal "
        - External Oblique.
        - Internal "
        - Transversalis.
      - *Lateral Cutaneous.*
        - *anterior.*
        - *posterior.*
      - *Anterior Cutaneous.*
        - *muscular*—Rectus Abdominis.
        - *cutaneous.*

## THE PECULIAR DORSAL NERVES.

- FIRST THORACIC.
  - POSTERIOR DIVISION.
    - EXTERNAL
      - *Muscular.*
      - *Cutaneous.*
    - INTERNAL.
      - *Muscular.*
      - *Cutaneous.*
  - ANTERIOR DIVISION.
    - INTERCOSTALS.
      - *Communicating.*—To sympathetic.
      - *Anterior Cutaneous.*
    - CORD TO LOWER TRUNK.
- SECOND THORACIC.
  - POSTERIOR DIVISION.
    - EXTERNAL.
      - *Muscular.*
      - *Cutaneous.*
    - INTERNAL.
      - *Muscular.*
      - *Cutaneous.*
  - ANTERIOR DIVISION OR INTERCOSTAL.
    - *Communicating.*—To sympathetic.
    - *Lateral Cutaneous.*
      - *anterior.*
      - *posterior or* INTERCOSTO-HUMERAL.
    - *Anterior Cutaneous.*
- TWELFTH THORACIC.
  - POSTERIOR DIVISION.
    - EXTERNAL.
      - *Muscular.*
      - *Cutaneous.*
    - INTERNAL.
      - *Muscular.*
      - *Cutaneous.*
  - ANTERIOR DIVISION OR INTERCOSTAL.
    - *Communicating.*—To sympathetic.
    - *Muscular.*
    - *Lateral Cutaneous*
      - *anterior.*
      - *posterior.*
    - *Communicating.*—To 11th intercostal.
    - " " ilio-hypogastric.
    - " " 1st lumbar, or DORSI-LUMBAR CORD.

# THE CERVICAL NERVES.

- **FIRST CERVICAL OR SUBOCCIPITAL.**
  - **Posterior Division.**
    - MUSCULAR.
      - Rectus Capitis Posticus Major.
      - " " " Minor.
      - Superior Oblique.
      - Inferior "
      - Complexus.
    - COMMUNICATING. — To 2d cervical.
  - **Anterior Division**
    - MUSCULAR.
      - Rectus Capitis Lateralis.
      - " " Anticus Major.
      - " " " Minor.
    - ARTICULAR.
    - COMMUNICATING.
      - To pneumogastric.
      - " hypoglossal.
      - " sympathetic.
      - " 2d cervical.
- **SECOND CERVICAL.**
  - **Posterior Division. or Occipitalis Major.**
    - MUSCULAR.
      - Inferior Oblique.
      - Splenius Capitis.
      - Cervicalis Ascendens.
      - Transversalis Colli.
      - Trachelo-Mastoid.
      - Complexus.
    - COMMUNICATING. — To 1st cervical.
    - ARTICULAR.
    - CUTANEOUS.
  - **Anterior Division.**
    - MUSCULAR. — Sterno-Cleido-Mastoid.
    - OCCIPITALIS MINOR.
    - COMMUNICATING.
      - To 1st cervical.
      - " spinal accessory.
      - " communicans noni.
      - " auricularis magnus.
      - " 3d cervical.
- **THIRD CERVICAL.**
  - **Posterior Division.**
    - EXTERNAL BRANCHES. —*Muscular.*
      - Splenius Capitis.
      - Cervicalis Ascendens.
      - Transversalis Colli.
      - Trachelo-Mastoid.
    - INTERNAL BRANCHES. *Cutaneous.*
  - **Anterior Division.**
    - MUSCULAR.
      - Scalenus Medius.
      - Levator Anguli Scapulae.
    - UPPER HEAD OF PHRENIC.
    - AURICULARIS MAGNUS.
    - SUPERFICIALIS COLLI.
    - COMMUNICATING.
      - To 2d cervical.
      - " spinal accessory.
      - " communicans noni.
      - " do from 4th C.
        - To Trapezius.
        - " spinal accessory.
      - " cervicalis descendens or supraclavicular.
      - " 4th cervical.
- **FOURTH CERVICAL.**
  - **Posterior Division.**
    - EXTERNAL BRANCHES. —*Muscular.*—To back of neck.
    - INTERNAL BRANCHES.
      - *Cutaneous.*
      - *Communicating.*—To occipitalis major.
  - **Anterior Division.**
    - MUSCULAR. — To Scalenus Anticus.
    - COMMUNICATING.
      - To 3d cervical.
      - With do from 3d C.
        - To Trapezius.
        - " spinal accessory.
        - " form supraclavicular.
      - " " " " "
      - " 5th C.
    - LOWER HEAD OF PHRENIC.
- **FIFTH CERVICAL.**
  - **Posterior Division.**
    - EXTERNAL BRANCHES. —*Muscular.*—To back of neck.
    - INTERNAL BRANCHES. *Cutaneous.*
  - **Anterior Division.**
    - MUSCULAR.
      - Scaleni.
      - Longus Colli.
      - Rhomboideus Major.
      - " Minor.
    - COMMUNICATING. — To phrenic.
    - UPPER HEAD OF POSTERIOR THORACIC.
    - Unites with 6th Cervical.—SUBCLAVIUS.
- **SIXTH CERVICAL.**
  - **Posterior Division.**
    - MUSCULAR. — To back of neck.
  - **Anterior Division.**
    - "
      - Scaleni.
      - Longus Colli.
    - LOWER HEAD OF POSTERIOR THORACIC.
    - Unites with 5th Cervical.—SUBCLAVIUS.
- **SEVENTH CERVICAL.**
  - **Posterior Division.**
    - MUSCULAR. — To back of neck.
  - **Anterior Division.**
    - "
      - Scaleni.
      - Longus Colli.
    - Joins United Heads of 5th and 6th Cervical.—UPPER TRUNK.
- **EIGHTH CERVICAL.**
  - **Posterior Division.**
    - MUSCULAR. — To back of neck.
  - **Anterior Division.**
    - Joins most of Anterior Division of 1st Thoracic.—LOWER TRUNK.

Accompanying THE SPINAL NERVES, by A. H. P. Leuf, M. D. [Copyrighted, 1882.]

1 Lecture II Oct 23rd Thursday - P. I

Next time - recapitulate short notes for lecture

At the conclusion of my first lecture Gentlemen I think I demonstrated to you clearly that bone is organ-ized. We now know that the bone is supplied

Bone organized

with blood vessels, nerves & lymphatics. You might however still make one objection, that as parts else-where where nerves are distributed have while in

Objection healthy bone

health more or less sensation, how is it that healthy bone gives us no evidence of its presence, and even when submitted to the surgeons saw will only give evidence of feeling upon sawing at or near the

Nutritious foramen

nutritious foramen. I can I think satisfy your minds upon that point, when I ask you to recollect that it is the sympathetic system which gives nervous life to the bone. A life indeed of a lower order a half sleepy existence, yet sufficient for its growth & development.

But let disease attack the bone, awake it from its dormant & quiet condition, ~~and~~ let thus the nervous sensibility be aroused and I warrant a pain, a pain so deep & agonizing so destructive ~~of~~ to calm & repose that the groaning martyr possessing these bones will be willing to admit that the whole nervous system is there concentrated.

He will not feel pain if the bone is sawn through its healthy structure, unless he saws through the course of the nutritious foramen. And hence in the

1st Gelatin then chondrin

Bone cells Lacunae - & C.
Corpuscles of Purkinje

Thigh we avoid going through the femur just above ~~the~~ its nutritious foramen for here we know that ~~the~~ it runs upwards. And even the Tibia not just below the Nutritious foramen there for here the vessels & nerve must run downwards.

Growth of bone — We now come naturally to the consideration of the growth and development of bone. We have seen how from a nucleated cell, a parent cell

Cell-nucleus nucleolus — surrounded by its nourishing Blastema, a gelatinous or Cartilaginous mould is formed. And this ~~Human~~ Gelat-inous ~~[illegible]~~ caricature of the future Man, ~~whether~~ perhaps to become

Cartilage — some great personage, ~~[illegible]~~ from the top of the womb must become ossified. cells at first similar then cartilage cells bone & membrane [illegible]

And while the cartilage cells are still forming Mother cells still forming daughter cells to become in their

At first — turn parent cells, thus increasing constantly in bulk, the blood begins to bring in the osseous matter & commences forming the bone cell in the midst of the

Bone deposited — hyaline fluid between the Cartilage cell

Canals Havers — The ossific Matter is at first deposited in a ~~[illegible]~~ ring

Lacunae — enclosing the future Medullary Cavity. As the bone

Communicate — cell becomes larger, and more of them are formed, the Cartilage cells must be squeezed to either side. They become flattened from a spherical to an ovoid form, & the ends of the one oval pressing against opposite ends of others finally coalesce & disappear ~~the~~ leaving a canal between the bone cells, called after Mr C. H Canals of Havers. The bone cells now radiating in every direction ~~[illegible]~~ open into these channels, and these tube like

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1862.

prolongations are called the tubuli Cali-ophori

From blood as Rachitis Chemists

That this bone is deposited from the blood, is proven by the fact that in Rachitis or Ricketts where the bones have no strength, are still too cartilaginous, the bony matter not being deposited, we find it elsewhere as in the urine as an earthy deposit. And by proper reagents Chemists have detected it in the blood itself.

Proof that B. grows in length & thickness Pigg. madder

Bone grows in length as was proven by the experiment of 2 shots placed at a certain 2 in apart in the tibia of a young pig. He was allowed to enjoy his dreamy ~~and~~ mud puddle existence for many months, and then on being killed the shot were the same distance apart but a greater length from either end of the bone, and also more imbedded. This shows that the bone grew not interstitially, nor by merely stretching out but by parts placed upon it at either end and upon its circumference. This last is still further proven by feeding a pig on swill with madder added to it, and then for a time before killing him discontinuing the coloring matter. An examination the bone will found when sawn in two, to show a white layer encircling surrounding a yellow one, which again encircles a white

P. IV

Flat bones membran. cart. Skull. Ribs. Larynx

All bones however do not grow in this way as the flat bones like the bones of the cranium in the membranous cartilage grow from one centre of ossification, the bony rays shooting out in every direction. And others like the

Vertebrae Temporal

vertebrae having many points of ossification, each piece being formed separately & then united to one harmonious whole.

Epiphysal layer

The growth of the long bones is limited & guided by the existence of the epiphysal layer of cartilage which prevents the Epiphyses from joining ~~on~~ too soon to the shaft. Growing with the growth of the bone till the ~~point~~ the standard is reached as determined by the direction of nature's laws.

Scrofula Shaft & Epiph grow

Disease sometimes however interferes, as in Scrofula and the Epiphysal layer of one side is not ~~un~~ossified & continues to grow for a longer period than the remainder. The consequence is that the shaft & Epiphyses will continue their growth till the cart is ossified & one limb will be really longer than the other.

Apparatus joints 1 Diar. 2 Amphi: 3 Synarth —

1. D. = En.. Ging. Arthrod: Di. Rot:

2. Amph: - Vert: pelv: = Symphisis

3. Synarth: = Sutura S.D: S.S: S. Sq: S. Com: S. Limb: Sd S. Harm: Sup: Max S. Schyn. Vomer

The apparatus by which these bones are joined together are called joints and we make three great divisions of them, 1st Diarthrosis, 2d Amphiarthrosis & 3d Synarthrosis. The 1st comprising the Enarthro~~dia~~-sis or ball & socket joint as at the hip & shoulder the most movable of all the joints, the Ginglymus or hinge like joint as at the elbow, Arthrodia, where there is sliding motion as at the wrist, & a Rotatorius or lat: ginglymus as at the neck ~~head~~ of the radius where tis held by the orbicular ligament. The Amphiarthrodia are those joints where but a limited amount of motion is allowed so as not to interfere

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P V

with the protection the bones afford as at the Vertebra and where the O. Innom - unite to form the pelvis ~~with the~~ # Sacrum by what is called a Symphysis.

The Synarthrosis is where we have no motion at all as in the bones of the Cranium where the union is by what we call Suture. S. Dentata as - parietal
S. Serrata - frontal bone
S. Squamosa as ——— Tem. parietal
(French head) S. Gomphosis - teeth S. Limbosa (Limbosa selvage) parietal
S. ~~Limbosa~~
S. Harmonia - - Sup. maxillary Schyndilesis - vomer -

apparatus - As these expanded ends of the bones would form anything but an easy moving apparatus alone, ~~we~~ have them covered and surrounded by structures to prevent friction & the consequent inflamm^n. Upon the ends there we find a dense white fibrous layer of cartilage called articular, which is forbidden to become entirely ossified although it becomes thinner as the Individual advances in life

friction
Artic: Cartilage
not ossified
Structure
Shorter at night
—
not organized
Inflam^n
Nourished
Injection
Knee joint Case

X This consists of fibres ~~placed on end~~ where the cells are placed on end, like the springs of a carriage placed in a vertical position, thus being more elastic, than if the sides resisted the pressure made on them

Individ - shorter at night

These Cartilages possess another important property to prevent the inflammation which would otherwise arise, they are not organized, but are nourished by the white serous portion of the ~~fluids~~ blood ~~body~~ which can exosmose from the blood vessels. This is now generally taught by the most distinguished Anatomist Malgaigne Velpeau & others. For the most minute injection that can be made does not enter the substance of the cartilage but collects in numerous & tortuous vessels

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which surround ~~the~~ it in every direction. And as was
told you when in an Amputation at the knee joint, from
suppuration of the flaps the Artic Cartilage was exposed to
the air, it gave no evidence of inflammation even under
irritation by mech. means, but slowly macerated in the
effused pus till it could be pealed off layer after
Lubricated layer. The danger of friction is still further guarded
against by a lubricating fluid being poured out upon
its surface, called Synovia, as it is a plain viscid
fluid like the white of an egg. And by a nice adapta-
Synovia - tion of the Master Mechanic Nature, it is always
amount × in proportion to the wants of the part being more freely
Secreted from effused when much motion is exercised & vice versa
organized & possessing the property of never becoming rancid secreted -
The Membrane is a delicate, transparent texture as
Artic or Caps. I show you here, not glands of Havers. + organized and ~~here it is called~~ is developed wherever in fine
Vaginal that friction exists. Here it is called Articular or
Bursae mucosae Capsular as it lines the joints, Vaginal where it
surrounds tendons & Bursal or Bursae Mucosae simple
sacs when placed merely between two surfaces as the
Is it Complete sack lig. patellae & bone below.
It has been supposed that it completely invests the
Inflam. Toynbee int. of joints covering the Cartilage, but we now believe
it does not in adult life. For the most complete
injection will stop short of its surface, and again such
a highly organized Membrane would certainly inflame
under the constant pressure to which it is exposed

Synov. fluid. = mem.

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Synovia teaches us meeting all the difficulties of the Question that in foetal life it surrounds the joint like a shut sack, but finally the opposed layers become gradually absorbed as we know the membrana pupillaris is, thus avoiding exposure to friction while it still performs its true function.

Fibrous-ligamentous or desmoid

Flexible

Strong

Sprain-cellular

not distensible

Organized.

As Periost: F.L.

tendons

aponeurosis

Nerves

P. Pott

On the exterior of this Synovial Membrane we find dense fibrous structures which evidently hold the opposed bones in apposition. This tissue is very great strength called fibrous, desmoid or ligamentous and as you see completely surround the articulation and yet are so flexible as not to impede the free motion. So strong is it that before it will tear it will rupture the bone, & come away with that portion to which it is attached. When we speak of spraining our joints it is not this proper ligamentous structure that is torn, but the cellular tissue placed around & between the fibres, which takes on the inflammation that causes so much suffering. It is not extensible, and when the joint swells from an accumulation of pus, ~~the~~ &c. it will not stretch but grow & enlarge under the stimulant of pressure

This tissue is organized and is furnished thorough sufficiently with blood vessels, and it is the same structure that we see here expanded into periosteum, forms the f. l. of the thigh, the tendons of muscles and the aponeuroses shown you in the M. ... lecture. The nerves

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_______________ 1862.

Lect 1st 21st October 1865 & 66

Session 1863 & 64.

Gent.,

I propose tonight to inaugurate my course of Demonstrations by recapitulating the first lecture of the course of anatomy.

In commencing I will promise to devote myself to your best interest, and will endeavor to bring simply & clearly before you the great & important truths that you have heard during the day lectures.

And I ask of you an attentive & indulgent hearing which will inspire me with the hope of terminating the session with you upon the same terms of friendship, which is my pride to recall, when I think of the noble ~~admirable~~ class that I had the honor to appear before night after night during the last winter.

I see with the greatest pleasure many faces around me which are ~~were~~ familiar & friendly ones, and I think I can refer you Gent. of this class, to them as Guarantee of my sincerity when I promise you my best wishes in your behalf.

I will meet you at 7 o'clk upon Tues. Thurs. & Frid. evenings and if you are punctual at that hour I will, as several Gentl. have requested me, give a few minutes to an examination of my previous lecture. A practice which I commenced during last winter, and with which the class were pleased. I will commence it then this winter & continue it my

it may seem [illegible] –

Study of the ~~human~~ structure.

owing to wonderful adaptation

Number of bones

Are divided

Must first study bones to learn relation

I commence this evening the Course of lectures, recapit-ulating the daily admirable teachings of the Professor of Anatomy. I feel great diffidence in following after my Predecessor in this department, whose great ability has been as you know recognised by promotion to Professorial dignity.

But I have promise you the full exertion of what feeble power I may possess in your behalf, and on the threshold of this Course to devote myself to your best interests in endeavoring to reimpress upon your minds the great truths & facts of this important & most useful Branch Anatomy.

I propose Gent. this evening to bring forward for recapitulation ~~the more important features~~ the subject matter of the 1st 2 lectures of the course

The consideration of the Human Structure opens naturally with the study of the Frame, upon which the various tissues & structures are stretched to make up the human form ~~divine~~, the Creature made in gods own image. ~~[illegible]~~ Man is made as the Lord of all ~~the~~ Creatida, beings on it, ~~the only being~~ to ~~[illegible]~~ walk erect upon the Earth

And it is owing to [illegible] wonderful adaptation of these dry bones to each mother, that ~~thus~~ the skeleton is ~~formed~~ made to carry itself erect upon the surface of the earth ~~[illegible]~~

In enumerating ~~all~~ these ~~the whole~~ bones ~~the 197 separate bones~~ we can fairly count 197 separate ones without including the teeth and the sessamoid bones small bones of the ear. They are divided into 3 great divisions the Long, Short & flat to which are added

Spine 26
Skull 22
Ribs 24
Sternum 25
Up. Ex. 64
Low. Ex. 60
197

Long Ossa longa.
Support & levers
open cavity
Phalanges

Short
Thick oss. crassa - of C. & T.
Vert.

broad Ossa lata
Organs

Compact portion
Exterior thick bones & Spongy
— Tables

the irregular. The long bones or ossa longa called Cylindrical, such as the bones of the extremities, are intended both as organs of support and as levers of locomotion. They have this peculiarity, ~~that they~~ are open cavity in the centre, for the lodgment of the medulla or marrow of the bone. And Bones which have this peculiarity though they have no more length than breadth, like the last of the Phalanges of the fingers are still classed as long bones.

The short or thick bones are called the ossa crassa, including the bones of the Carpus & Tarsus and even those of the vertebral column, which are however so irregular in shape as to be by some Anatomists placed in a distinct & fourth class

The Flat bones, ossa lata called also broad bones, such as the bones of the Cranium, the Scapula, and the os innominatum of the Pelvis are intended mainly to protect important organs placed within the cavities whose walls they form.

The exterior of all these different classes of bones is compact. In the thick bones this compact portion is a very thin layer, as it is also on the spongy head of the long bones, as you see by these specimens into which I can readily thrust this Awl.

On the broad or flat bones it is spread out into a broad sheet or layer which are called tables, so that we have an internal & external table to all the broad bones.

Long bones
nearly all compact
like ivory of E. S.

Saw in 2
Interior honeycomb

so in thick

in flat diploe

so in vertebrae — nervous tissue
diploic ven

Reticulated — in strong bones

In the bodies of the long bones the compact portion forms nearly the whole structure and is solid and impenetrable to the air like the Ivory of an Elephants Tusk, which is in itself but bone.

When we saw in two specimens of these 3 classes of bone, we find the interior full, filled with a more open, honey combed structure, which is called the spongy or cellular structure of bone.

In all the thick bones and in the epiphyses or heads of the long bones, which when separated resemble thick bones the spongy or cellular structure is precisely the same.

In the flat bones it is the same in reality but from its being spread out in a sheet ~~or~~ between the two tables as in the skull it is called the diploe or meditullium.

As the bodies of the vertebrae, likewise surround a part of the nervous system, the term diploe is by common usage, applied to the spongy substance of the bodies of the vertebrae, and the veins which run through the arborescent grooves in the diploe are called diploic sinuses - (Show Sinuses of vertebrae, Skull in Breschet's plates -)

In the central cavity of the long bones, there is but a small amount of the cellular or spongy tissue, and it is so open and net like in its structure that it has been called the reticulated tissue. It was not here needed to give strength to the bone, and it is only found in

fr adipose cells

Tapers

~~[illegible]~~

irregular Canals

Canaliculated

all the same

density

in sufficient amount to give support to the adipose cells in which the marrow of the bone is lodged, as you see by this section of bone which I show you and this plate {Dr Wallace}.

In the central cavity of the long bones, there is but a small amount of the cellular or spongy tissue, and it is so open and web like in its structure, that it has been called the reticulated tissue — It was not wanted here to give strength to the bone; and it is only found in sufficient amount to give support to the adipose cells in which the marrow of the bone is lodged, show section of bone & wallace plate — But if we look at this cavity as it approaches the two ends of the bones, we shall find it tapers to a point — ~~just~~ where as the compact portion, thins itself by expansion on its inner face, so as to give greater breadth to this part of the bone — Here the vessels of the compact portions, which run in grooves so small that we cannot see them clearly without a magnifying glass, run on ~~out~~ between these more open layers towards the head of the bone, in a series of irregular longitudinal canals — for this reason, this portion of the spongy tissue between the ends of the ~~xxll~~ medullary cavities & the Epiphysal heads of the bones, is often spoken off as the canaliculated tissue of bones — But you will at once see, that this canaliculated tissue (showing specimens) this reticulated tissue (do this true spongy tissue of a thick bone (do — os calcis) and this diploe or meditullium (do) are all nevertheless but so many varieties of common cellular or spongy bone —

— Now though there, such a great seeming dispar[ity] between the ~~cellular~~ spongy & compact, portions of the bo[ne]

Negro Scull

Inflames

Equal Sections:

Tis so. Sponge

Ivory balls.

Not Fibrous

is there any real difference, other than what can be explained, by their different degrees of density or Condensation — I have shown you that the spongy tissue differs in appearance in the different classes of bones — and sometimes as in this very Scull, (show Negro's Skull) you see this diploe is a half an inch thick and as solid as the compact layer — It is well known that when the compact portion of a ~~bones~~ bone, inflames without falling into necrosis that its very densest structure becomes to a certain extent cellular or spongy — And if we macerate the Compact portion of a bone, in water after its earthy matter has been removed, it becomes very soon open & spongy in its structure — We know that equal sections in length of a thigh bone like these are if nicely made, exactly equal in weight, whether we taken them from the spongy head or the Ivory like portion of the central shaft —

— It is then very proper to say, that the component structure of all bones, is cellular — and as I represent in this sponge, the condensation is greatest in the centre so as to narrow the bone, without diminishing its strength and ~~give~~ make room for the bellies of the muscles, without rendering the limbs clumsy; while the heads of the bones are left expanded, to give stability to the joints —

— This spongy structure, has also been proved as by the experiments with these balls, to have the effect of deadening shock, so as in falls upon the feet to protect the brain against concussion —

— We know that some anatomists speak of the bones as being fibrous, the fibres running in different directions —

— But experience has shown, that after macerating a bone in acid, the fibres can be torn just in the direction the

Chemical

Macerated

bone Cart & Gelatin

Burn

Strength or Protection
Saney

Berzelius - 1/3 an 2/3 E.

children 1/2

Old - 7/8

vessels run in any particular bone —

— We will now briefly allude, to the chemical composition of bones, — Here is the exact counterpart of a bone so ~~far~~ as regards its size & form —

— But see how little of the hardness the great attribute of bones it really possesses — we can tie it in a knot, we can fold it up & put in the pocket — It has been steeped for days in a weak solution of Hydrochloric acid till all the earthy matter has been taken out — What is left is animal matter — bone cartilage you might call it — and if we were to boil it for a sufficient time in water, it would be turned into jelly — In this other specimen we have still the shape of the bone preserved — But the bone is now brittle, & friable — converted into a sort of chalk — No longer capable of forming a support by which we could stand, or forming a protection to the brain — Now these two different substances — the earthy & the animal, must ~~be mingled~~ be mingled & coexist, to make the stubborn unyielding tissue that we know as bone — When I think of the mingling of these materials — Larrey's ~~di~~fficulties in the Egyptian desert occurs to me when he wanted splints for broken limbs and had apparently nothing to make them of but wheat straw — He took the wheat straw, stuck the different particles together by mixing them with white of Egg & Aluminous earth dried the mass, and he had firm stiff unyielding splints — bones themselves as femur

— Now Berzelius account of the composition of bone

6

is as follows —

— It will be sufficient for you now to recollect that in a Man of 25 or 30 — the Animal matter forms one third — the Earthy two thirds

— It will be well also to recollect — that the proportion varies always with the age of the individual,

— In a child the earthy matter is only one half — in a very aged man, the earthy matter forms nearly 7/8 of the whole weight of the bone — In consequence the bones of a child will often bend considerably without breaking or only break in part — while in old persons, my own experience the bones will break, when but a slight strain is made upon them,

— It will next be necessary to enquire into the organisation of bone

But I find my hour so nearly elapsed, that I cannot conclude what I wished to say in this lecture — and fear to trespass upon your patience — but as I go on & get more experience as a lecturer, I hope to gain more of the power of condensation —

Organisation
ser. Cut. sudn

Blood V. Specimen

Amp:

b.v. enter millions

attach light

to minute canals C. II

communicate
Quicksilver

Periost: vascular
Bed

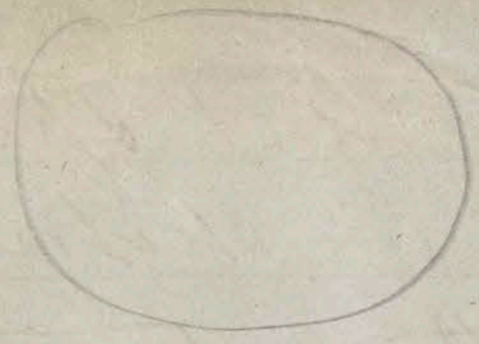
magnified drawing and in this wet specimen (one in a bottle to be taken out with those that have shown them)

— This serves as a bed on which the arteries ~~& veins~~ ramify very minutely before they ~~are~~ passed into the bone — The veins ~~at~~ at least equally numerous are also found in it — Besides this ~~important~~ service of keeping up the life of bone the periosteum serves as a protection to ~~the~~ bone against the pus of abscesses, affords an attachment for the tendons of the muscles, and is in direct connections with the fibrous bands which make the ligaments of the joints

— When we lay open a long bone we find lining that cavity another periosteum called the internal periosteum, medullary lining membrane or endosteum — This is also supplied with blood vessels, which come partly from the spongy ends of the bones but mainly from the one single arterial & venous trunk, called nutritious artery & vein

— These pass by what are called the nutritious foramina of bones, one two or more of which are found in all the bones having compact structure — As for instance here in the broad bones (take an innominatum or a Scapula) or in this thigh bone, where you find it running up towards the hip, or in the ulna where it is ~~dis~~ directed down towards the ancle, in consequence of the position of these two bones in the Embryo foetus ~~the head~~ it being at the close of its life in the womb with the head uppermost and the knee bent against the chest — gravity then as the blood vessels were forming themselves, would direct the blood in the two different directions in these bones,

— This endosteum or medullary lining membrane

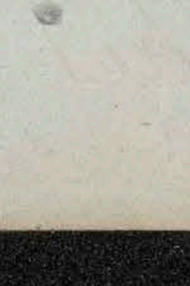


Vesicles Vascular
adipose cells
Caps

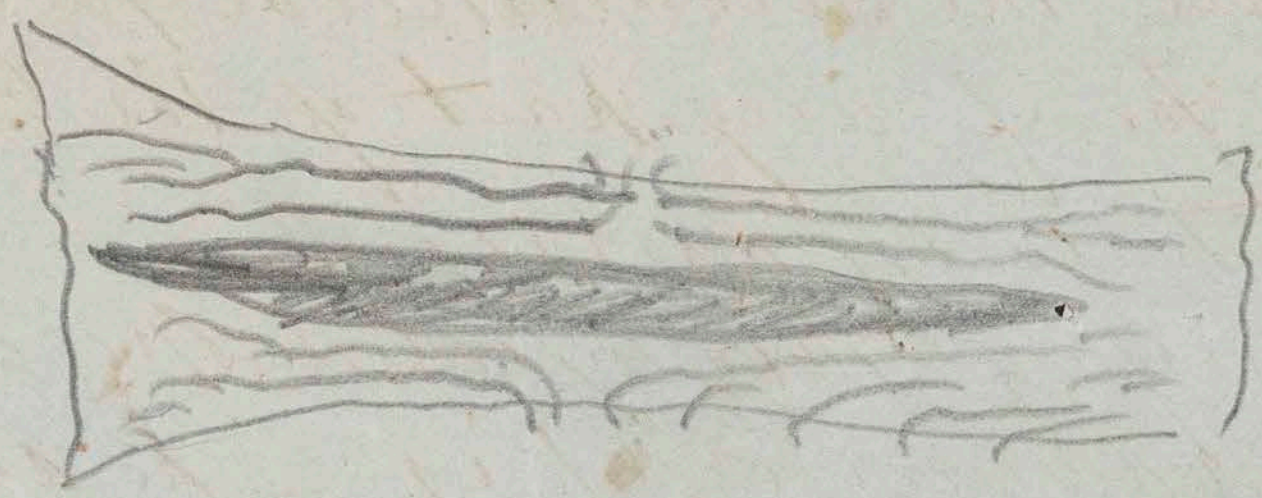
fat varies

Lymph.

Perichondrium
~~D~~ is it before cartilage



After what has been said to you in reference to the organisation of bone, it is necessary for me merely to show you the anatomical proofs of its vascularity — For if any part of the body receives bloodvessels, that is organised —
— You see by the redness of this injected specimen & that & that, how very vascular it is — In amputations of the limbs, we have often to wait in the dressing, in order to stop, with pieces of lint wetted in cold water, the bleeding from the vessels in the bone.
— The blood vessels enters, by millions of minute orifices on the surfaces of all bones — on the spongy bones & on the spongy heads of the long bones, there are visible to the naked eye, as you may see on the surface of this bone — All of these pits are not however for bloodvessels; some are for the attachment of the ends of the ligaments of the joint, giving them a firm hold.
— On the compact portion, the orifices for the entry of blood vessels are so small that it requires a microscope to see them — These orifices lead to minute canals ~~running~~ lengthwise in the long bones, which are also microscopical and are called the canals of Havers, or Haversian canals — after Mr Clapton Havers, who discovered them — All these canals besides communicating with one another frequently by lateral branches, open out into the cancellated portions of the spongy bones.
— So in the dried bones, if you were to pass quicksilver into these canals, from an elevated tube, you could fill both spongy ends of the bones —
— The close fibrous investment of the bone called periosteum which I show you here, is exceedingly vascular as seen in



~~is~~ Protection
of to Ligt.

Lay open longt.
Endost.

nutritious a.

Living in Wants

Artict

besides, giving off blood vessels on all ha[...] to the inner surface of the bone. divides into ~~a series~~ millions of minute adipose cells, which supports on the spicula of the reticulated tissue (show again reticulated tissue) like so many caps or bonnetts, hung upon ~~the~~ wall
— These caps or little sacs are covered with branches from this medullary or nutritious artery, and in the healthy state of the bone are so filled up with the fat or marrow which I show you here (— ) as to completely distend & fill up the whole medullary hollow —
— ~~This~~ amount of this fat varies ~~in diff~~ according to the condition of the health — In a scrofulous or cachectic subject the fat is less in amount & more watery — the Membrane which as you see here is very delicate, is apt by a little knock against the bone to be detached from it and the internal layers of the bone dies from want of its nourishing vessels.
— In some cases it seems too abundant and to give pain by pressure — A case of this sort has come to my notice, ~~where~~ A patient from taking codliver oil grew suddenly enormously fat — This change was followed by pains in the interior of all the long bones — which were not relieved, till she had thinned herself down again a little by taking Iodine — In Syphylitic Rheumatism the pains which are made worse by the warmth of the bed, are believed to be owing to the inflammation of this endosteum,
— Next we will consider the growth & development of bone
— All bones are laid down in a cartilaginous mould, enclosed by a external periosteum — Whether the periosteum which then as it covers cartilage, or chondria, we ought to call

ship 2d mth

Spermacetti

perichondrium, exists [illegible] cartilaginous mould of the bone or not, I cannot say — But I think it probable — For the ossification of the bones of the foetus, begins very early — say about the end of the 2d month — — But recollect, you are not consider the bone as laid down in a long cartilage like a ~~[illegible]~~ spermaceti candle with only a little bony point in the centre like that — Such bones would be bent in the foetus probably

— The ossification begins when ~~as in this~~ the bones are very little things, and the cartilage forms but a small part, on either side of the ossific line thus — you see in this little diagram, I have separated the ends of the bones, from the middle — The two epiphyses from the diaphysis or shaft — and the cartilage lays between — just as in this specimen, you see how easily the Epiphyses and — the irregular surface, by which they are join[ed] — And in this recent preparation, you see [the] very cartilage that forms these junctions, [is] vascular, and which is the bed where all the deposit of bone is laid down in order to increase the length — The breadth of thickness of bones is increased in part by the effusion or layers of soft plastic matter under the periosteum which become ossified

— Where ever ossification goes on there is always vascularity & redness. The point of the nutritious foramen where the artery enters is the point where the ossification of the long bone begins in a little [illegible] of [illegible], which is gradually filled out [illegible] so as to make a little shaft — [illegible] & the flat bones grow by one or m[ore] [illegible] rays shoot out — in the thick bone, like [illegible] — in the flat bones, in a thin sheet — The [illegible] ossified separate from the shaft, to let the bone grow in le[ngth]

would go - then another, and another, going - farther with a little deeper insight into the Subject, would add some new facts, to the preceding - ones - or sometimes overthrow them entirely - In this - way, Sciences of every sort - seems to have had its - origin, and growth. All true facts of discovery, - whatever they may overthrow, - are assimilative and naturally unite, and so form a body of - doctrines. It is interesting also to observe, how - near some of these greatly distinguished Men, - approached without solving the great Marvels, - which startled a succeeding age - as the circulation of the blood and the functions of the nervous system. We now enjoy the rich - treasures of Anatomical knowledge, that the Scientist of all ages, ~~have~~ slowly and labori- - ously piled up - The unthinking, might be - tempted at this present time, to smile when they learn, how slow ~~and~~ doubtful and halting - were the first steps of discovery, into the Un- - known Structures of the human body - These slow steps however they were made, were the result of the efforts, of Men of extraordinary capacity of unbounded industry, often the favorites of

Where bone irregular – as frontis, 2 centres. Temporal
In hydrocephalus new centres, same perhaps for os. Wormiana
hence in this Specimen bone pressed out. History of ascension
takes place of bone is solid tapped do not recede. no cure.
Architect. Stiffness – thickness of bone. protection
occip. by groinings. Churches.
Head divided description Cran. Face. 8. 14. Names.
Synop. This one is os frontis. for convenience. 3 divisions, Front. orbit. nasal
Concav. & vex. brain. Supercilliary ridge. Nasal boss. covers
Spec. Frontal sinus. to middle meatus. Schneiderian memb. same
diseases. Cold. Tension. F. headache. not mere expansion
of diploe. fortunate – As child dim. decrease. M. Brain
2 prominence = Centre of ossif. Inside. Long. Sinus. D. M. & nerves
foramen caecum a vein nasal Orbital portion thin broken
protected position, Ext. & Int. Processes of Orbit. portion of F. B.
Skin. Henry 2d Duc de Montmorenci, uniting with malar Ext.
Int. with nasal. proc. of S. m. & ethmoid, Lachrymal gland
Terms of Ethmoidal notch, Nasal spine
Supraorbital notch or foramen. frontal B. of Ophthalmic a.
X pulley lig. for trochlear muscle. Varies in size
Ant. & Post: Eth: foramen

Parietal bones: parietes. unite with many bones
Shape $4^{8}.4^{a}$ C. Cv. grooves for Art: of D. M. Sides. A. P. & Inf.
Angles F: Occip. Mast. Sphen.
Ant Inf. only import – Art. men. media. Rupture. Trephine
clot of Pneumogastric nerve. Place them together
Longitudinal sinus. Parietal foramina into Long. sinus. Cups.
not the only ones. as vessels in bone Communicate only for larger
Simple bone. prominent. Protection to Brain. Arch for this purpose

hence 2 to assume that from

Extract from Lecture V - The Parietal - artic agrees Temporal
bone. name white hair. Articulates. Pari: occip. Mal. Sup max
Sphen. Front. & Inf. max. have mentioned Sutures hence only.
Commence 3 parts. Fr. Sq. P. Mas. developed. squamous
from lect V. Shape, C, &c.
Occipital - Rhomboid. 4 sides. 4 ang. Articulates. Foramen
occip. mag. Basilar
Condyles. developed by in 4 parts 5 points oss. ossified 8th & 10th
Occip. protub. Lig nuchae. Sup & Inf. Semicir. Ridges. or Curved lines
Insertion of muscles. Inside - occipital cross & groovings
Sinuses long. 2 lat. 1. occip & Tor. Heroph. to become jugular vein
Falx cerebri Cerebel. Tent. &. fossae for lobes.
Ant: Condyloid. Hypoglos. nerve
Post " vein to lat. sinus. Basilar. Mucous. Memb
Tubercle muscles of Pharynx. Groove for cord.

# Lecture III Oct. 24th 1862

Last evening – finished with Sutures of Cranium now Coronal, Lamb. Sagit- Squamous – where they are + additamentum. Cranium 8. Face 14. why so?

2. common to both, Ossa triquetra. Wormiana most common in Lambdoidae. Important as the older Surgeons as fracture. Called to a child with a blow on head or fall. hence recollect them

Why then so many bones & sutures. From foregoing laws of ossific growth. Radiations with difficulty to all over head & hence

~~Arched form~~ ~~of head~~ arch ~~Resist blows~~ & ~~Shaped to~~ viscus shell of an egg. Another mechanical means for strength Squamous as overlapps a tie beam. Force transmitted to base of Cranium & bleeding at ears & nose.

Sutures not a limit to fracture as older skulls are solid. commonly as
Specimen – 121 yrs old. And fractures as extend across them

~~Hence 2 good reasons~~ And gain s development & parturition when they overlap — freaks

Of. no skeleton. But women, recited the last of test.
Uterus so strong. must. bones necessary.
Condemned to two things travail. & Consolation to man.

To understand suture. recollect Membrane form Cartilage 2. Memb. Peri. & Sl. M. If loose would separate. hence fastened by junctions serve as partitions & divide the bone easily & gracefully – limiting And as it is irregular. dovetailing & Wormiana where oblique Squamous ~~[illegible]~~ [illegible]

## Frontal Neuralgia

Its importance you can appreciate when you reflect that the great Statesman & orator whose eloquence electrifies & ~~[illegible]~~ controls whilst his brain may direct the destinies of ~~the world~~ nations would by these bones flattening but a little, be reduced to the mournful condition of the Gibbering Idiot with vacant stare & slobbering speech.

is a slow one & hence under constant exercise of the

lights on feel no inconvenience, & if simply incised merely

give no pain. As was shown by the distinguished P. Pott

who when suffering from a compd fracture of the thumb

held his hand behind his back, & ordered a portion of

the tendon to be cut, which was done without giving

any pain. - - Intervertebral Cartilage, Blood vessels

Tissue Jaune - differs from L. T. Color. elasticity -

Ligament Nuchae Ox.

# United States Army General Hospital,

MASTER STREET, PHILADELPHIA,

Anatomy is the study of the human machine, with which we have to concern ourselves as Practitioners.

L. 3.81 Joints - inflamm[n] acute cart. - 2. Cartilage

L. IV - Serous - cellular - fibrous -

Skull - 8+14 - Sutures - all bones except Hyoid bone

2100
1260.

1887
1770
117.

Monday. Oct 2nd 1893

B Lecture

Introductory not given until Oct 5. 93 – a mistake

Should have a first lecture to grade opinions

Introductory to course

Round up lecture, with skeleton showing my hope on, the advantage of the drawn with a number of Bones in contrast to Solid skeleton – perfection – then 5.00 [illegible]

Thursday Oct 15. 91. Lect 6th
Spongy. bone. Articula
Physick
Bone organize
Vascular
Growth development
Epiphyses. Sutures
Skull - 14 bones

Monday 19th Lect 7th Growth &
Tuesday 20th " 8th development
Long & bone
Examination on
Growth &c of Long Bones
Thursday 22nd 91 - Growth of Muscle
of Broad bones. Muscles Sutures Epiphyses
Skull

Sutures. Wormian
bones. Interlocking
Sutures. dove-tail &
plane -
Names Coronal Sagittal
Lambdoidal Squamous
8 - bones in skull
14 - " " face
Frontal bone -
Cartilages. arrangement

Med. Chir. Col - Thursday

Surgical anatomy

1st Lecture Thurs. Oct 4. 94

Introduction. Skeleton

Summary

2d Lecture - Composition 1/3 A -

Oct - 11. 94 — 2/3 - E

Growth from Blood Pegg.

Larry (Baron) Eggs a Straw

Smoke spine

Bones of the Pharaohs

Rachitis. Arms bones & Skeleton —

Epiphysis

Joints — 14. metacarpal bones

Synovitis — cartilage

2^d^

No of Bones

1/3 an - Lay. - Eggs

2/3 E - Pharaohs bone & Shar

Growth - from Blood

Rickets - Bones skeleton

Peggs Bone

Epiphyses - fracture

Metacarpal - 14.

Joints

Cartilage

Synovia

Lect 22 Session 1888-89 - Oct 4. 88

Spongy - Centre of bones Cellular
- Ends of long bones
Organized - Equal lengths
" weights
Scratch, bleeds
Cut - - Granulations
Burn - - dies -
Ivory balls
Physick

Inflammes

Blood Vessels -

Amputation -

Holes in spongy cells

Nutritious foramina - Gravity -

Periosteum - Bed. Recruits
Ligaments & tendons

Endosteum - Cap or peg - Jarells

(over) Scrofula Syphilis Contusion

Cod liver oil — increase fat

Diminish pressure

Take Iodine

Bone grows ?

Skull. 14 bones in the face

8 " " " Cranium

Fracture trephining

Sutures — development

do not limit fracture

as none in old brittle skull

Coronal. Sagittal. Lambdoidal

Squamous —

cells
[illegible]ellata - Cavity - leg bones -
[illegible]nalicutali - Ends - Spreads
Same - Equal parts = weights -
Density - Inflames - negro
Cellular - Sponge - muscles -
Physicks - iv - valles
Organized - prosph - blood vessels
Specimen - Amputation
holes in sponge - object in health
Communicate - Quicksilver
Scratch - Red - brown
Periosteum - Bed - protects
ligts - muscles -
Endosteum - nutrit art vein
Caps - adipose cells -
nutrit foramen - Gravity - Swing
Heat varies - Scrof Syph - Cod liver oil
Perichondrium - Pendicmium
not in mould - Spermaceti - bend -
teeth

Human Anatomy

No of Bones - 197 - 253

Foetal - Skeleton

Various Shapes - os lat: long

Crassa - & Ir

Os. Longa - levers - Canal = Phalan

" Crassa - C. T. Vert -

" Lata - Cran. Th. pelv. Scap -

Substance - Phys. { hard - dense - Sp. gr. Color - Elasticity

Spongy - cell: canal reticulated - conglomeration - spongy

Chem - Berz - Mac - Bur.

an 1/3 - E. 2/3 -

Larrey - Femur -

Varies - 1/2 child bent - Rickett.

Earthy m 7/8 Age - Fragil - Ossium

Connection buttocks & knee pa-

Shape of Bones - Exterior - art -

Interior - Spongy - cell - os cancellous

next time unti. newhan

rules to carry on -

Lect 4 — 12 Oct 1891

Property of Bones 1/3

Chem & Physical

Lang. { Egyp. clay straw / Pharaoh

Rickets —

Shape of bones

Ex. hard, int. spongy

Ends cancellous

Artic. — spongy.

organized

Growth —

Lect. 5th Oct. 13. 91
Bones

Spongy Structure

Ext hard. Int. Expansion

Haversian canaliculi. spongy like

medullary canaliculati —

{ Ends. Expanded to make

canaliculated Articulation

{ Shock. Ivory balls —

{ Equal lengths.

{ " Weight —

{ Bone organized —

Periosteum. Endosteum

Scrofula Syphilitic —

Growth & development

Pure descrip Anat-
3000 years
attained last century

Haller Physiology

Morgagni Pathology

Bichat General anatomy
statue in Ecole de Med
Paris

Lepan. Malgaigne

Richter. Langenbeck

~~Hunter~~. Cooper—

Mütter. Horner

McKatlin & in this school

to the practice of medicine
and surgery—

Allimrad

to Mr Kane

Plumbi

Landmarks – 7th Cervical

Pomum Adami –

Quadrangle – St. Cl. Mas

3 - divis. - Spine. tracheal - lateral

Castlereagh Tumors –

Elasticity – End 12d lecture

Lecture 3d April 10th Superficial Fascia –

Emphysema –

Platysma – bleeding – Monad / Physic

Card –

Fascia profund. Cervicis

Goitre –

Triangles –

pass needle –

Pneumo Gastric Nerve

Vein – pins –

Simmons – Mirabeau

Lecture 2d April 6. 166

Organization - Scratch - Vedu-
rcephine

Scrofula - Syphilis -
Testill in blood
Growth & development bone

6th or 7th week - Jaw - clavicle
4th ~~mth~~ cornu Hyoid

~~Pig - shot. Madder~~ -

Membraniform - Sutures
ossa Wormiana.

Joints - Articular ends

Physic -
~~Sprain~~ -
~~Percival Pott~~ -
Diarthrosis - Synarth -
amphi -
Neck - space - skin
Size - man
Woman Malignance

Bone grows from blood

Development Darwinian

Membraneform –

Centres of Ossification

Cartilage growth of bone

Joints –

protected by articular car

lined by synovial membrane

fastened by ligaments

[illegible]

cushioned by pads

C. P. [illegible]

Tissues –

Tis. form

from a mass of cells, lying on the primitive groove, the rudiment of N. system, soon to be covered in & supported by placental structures & foetal membranes. for its development as a beautiful building is surrounded by scaffolding in the course of its erection. As the N. syst. the abode of the animal & soul grows. so is multiplied the scaffolding until the body it becomes perfected. & by the organs of the senses, has the most perfect scaffolding for its support & development, so that by this means information of every needful sort may be conveyed to the Brain. for its development the instruction of the vital principle. until that immortal spirit has reached its earthly development. & the time of its stay on earth is finished, then the scaffolding around the soul all earthly supports are taken away and the body brain & all are laid away, dust to return to dust. & the spirit which once inhabited it, wings its way to another

 1st Lecture


℞ 1872–73 —

Notes on Lecture on Nervous System
given Thursday, my first winter
lecture —

and to return higher life, probably
carrying with what of instruction
& improvement it may have obtained
on ~~earth~~, as a point of departure
for still more ennobling and more
exalted development in our future
eternal home. If this thought is a
true one, how serious is it, & how
great our responsibility to improve
our intelligences while we have the
opportunity to enact — No moments.

The N.S. is divided. 2 great systems —
protected in cavities, & branching throughout
is that a Skeleton of nerves.

Lect 4th Oct 9th 83

Oct 7. 84

Anatomical Grammar

Joint - Formed Solution

to deaden shock & give

motion —

Skull Sutures —

— Sag. Lamb. Coron

Squamous —

no of bones —

ossa Triquetra

Sutures — why —

do not admit - fracture

periosteum fastened

Thick skull

Hydrocephalus

Frontal bone

Lect 3d Octr.

Coronal. Sagitt. Lamb. Squamous

Bones of skull 8. 14. Os. Triquetra

Fracture — : Trephining

So many bones & sutures. Development — membrane & cartilage — (preceding the bone)

Parturition. Undres strong. bones — necessary

If no skeleton. but travail in pain

Suture limit fracture. old skull 121 yrs.

by a mechanical means. Squamous

Understand Suture. pericranium fastened

Irregular bones - sev: points

Hydrocephalus - New centres — Architect

Dif: thickness. a protection - openings

Os. frontis sincip. 3 divis. F. O. N

nasal frs. pont. headache. Expansion Diploe

children

Orbital Henry II. Frontal neuralgia

Parietal .4. Art: Mm. Med.

foramina. Cups. Arch. protection. Statesman

Occip

Occipital

Lecture 9th 1867. May 7/67

Examination

Floors of triangles - have seen carotid. -

recep. nerves. Lymphatic glands

Subclavian - Sup. fascia -

Floor. Inf. Carotid triangle.

" Sup. " "

Arteries nerves. - Lord. Castle

Genl Bayard escape

~~Oesophagotomy~~ -

Sub max. triangle - Floor

Glands. Sub max & Parotid

Tracheot & Laryngotomy -

Session 1888-89 –

Lect – 4th  Tuesday  Oct 9. 88

~~Lect 5th~~ – Thursday –

7th & 8th Growth & Development of Bone

Lect 6th Fr. Wed. Oct 12. 88 –

Sutures. Coronal. Saggittal

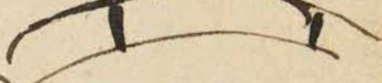
Lambdoidal

Wormian Bones [illegible]

Suture does not limit Fracture –

as old people have no Sutures

Skull – 121. years old –

How Suture is made – 

Hydrocephalic Head –

Skull. 14. Inner face of cranium

Frontal - Supraorbital 5. O. N.

3 stories

Nasal - Boss frontal headache

Trumbler marking of

Tumours.

Children not diploic

Orbital - Henry II. Jennings

Parietal - Ant. meningeal mark

Occipital - - foramen mag

swallowing fish -

Lecture VIII - 9C

Lecture VII & VI - by
read, attic Treas. in

Growth & Developm

of Bone

how enlarge

Bone

bone c

From Blood.

Piggs bone

Canal of Haver

Periosteum - { vasc
Prote

Endosteum - vasc

passes from M

if knocked o

cells - Fat va

Cod liver o

Cartilages
s Larynx
ication - Sutures
- horrin longbone
Scrofula.

is - how made
not blood vessels
tage - not organized
nourished
flammation
ovial memb. highly
organized
ck (Toynbee)
sular - Bursal -
desmoid ligaments -
surrounded by pus -
St) Periosteum Fascia lata
aponeuroses
- Int vertebral, vessels

essions 187 3 T. Th. Fr.
Lecture 2a 3rd No
aptation - 197. 204
Supports levers -
cavity - Phalanges
- carpus. Tar. Vert.
- organs. Pelvis &
tebrae.

- Elrumalia - like
of Elephants teeth
- sawn in half -
thick  Sponge
flat -
ed - for adipose cells
eated - Papers
ivory balls - Physic
lis - Burn - Inorganic
one cartilage Gelatin -
Larry
Eccentric Fracture

Fragilitas Ossium
old - 7/8. earthy -
organisation -

Objection in heal
Nutritious food
Growth & develop
Cart. deposit
Bone cell
from Blood -
Pig's bone
Canals of Havers

Periosteum - vasc. bed
Endosteum - v
Membrane form
cartilage
Skull - Ribs - Larg
points of ossificat
Lenght Growth -
Epiphysal layer -

Lect. IV (~~Da Costa~~)

chemical composition 1/3 an 2/3 Earths

Rachitis. Epiphyseal layer. Scrofula

Joints [1]Diar[2]Amphi. Synarth

1. Enar. oss. Ging. Arthrodia. Di. Rotator

2. Amphi: Vert. Pelvis Symph:

3 Synarthrosis) – Gomph. Dentosa – Alveolar Serr

Harmonia. S. Max. Schyndilesis Vomer

Artic Cart. not organized. Lubricated

Capsular. Vaginal Bursae

Tissue jaune. 8 Bones. Skull. triquetrae

use of suture. Dif. thickness

frontal bone

~~Medulla ... ...~~

Oct 23/63 Lecture IV. Temporal bone (Blanch

Tuesday Oct. 21st

attic. 3 parts. Mastoid. Auditory
meat. Tympani. Squamous.
Shape. Covered. T. m. Zygoma. Jugum
Tubercle. (Convolution). Glenoid. & fissure
For. C. Tymp. Vid. N. Laxator T.
Accommodate sound
Mastoid cells - fistula
hearing. Ligat. Occip. &c
Petrous. Shape Tentorium &c St. A
Apex. in Pharynx. Parotid
Ex. meatus. 1 1/4 in long. foreign body
Tensor Tymp. Eustachian
N. Jacobson. N. in Audition 4

~~Occipital~~ — ~~Sinuses~~ Tentorium
Caries ~~Alternation~~

# A DIAGRAM OF THE SPINAL NERVES.

(Accompanying "THE SPINAL NERVES," by A. H. P. LEUF, M. D., Copyrighted 1882.)

# THE CERVICAL PLEXUS.

- FIRST CERVICAL.
- SECOND CERVICAL.
- THIRD CERVICAL.
- FOURTH CERVICAL.

**CERVICAL PLEXUS.**

- SUPERFICIAL SET.
  - ASCENDING BRANCHES.
    - OCCIPITALIS MINOR.
      - *Muscular.*— Occipito-Frontalis.
      - *Auricular.*
        - *muscular*—Altollens Aurem.
        - *cutaneous.*
      - *Cutaneous.*
      - *communicating.*
        - To Occipitalis Major.
        - " auricularis magnus.
        - " posterior auricular (of 7th).
    - AURICULARIS MAGNUS.
      - *Facial.*
        - *cutaneous.*
        - *communicating*—To 7th.
      - *Auricular.*
        - *cutaneous.*
        - *communicating*
          - To Auricular of 7th.
          - " " "10th.
      - *Mastoid.*
        - *cutaneous.*
        - *communicating.*
    - SUPERFICIALIS COLLI.
      - *Ascending.*
        - To External Jugular Vein.
        - " 7th.
        - " Platysma Myoides.
        - *cutaneous.*
      - *Descending.*— *cutaneous.*
  - DESCENDING BRANCHES.
    - SUPRA-CLAVICULAR.
      - *Internal* or *Sternal.*
      - *Middle* " *Clavicular.*
      - *External* " *Acromial.*
- DEEP SET.
  - INTERNAL SERIES.
    - COMMUNICATING
      - To pneumogastric.
      - " hypoglossal.
      - " sympathetic.
    - MUSCULAR.
      - Rectus Capitis Anticus Major.
      - " " " Minor.
      - " " Lateralis.
    - COMMUNICANS NONI.
    - PHRENIC.
      - To Diaphragm.
      - " Pericardium.
      - " Pleurae.
      - " Peritoneum.
  - EXTERNAL SERIES.
    - MUSCULAR.
      - Sterno-Cleido-Mastoid.
      - Levator Anguli Scapulae.
      - Scalenus Medius.
      - Trapezius.
    - COMMUNICATING —To spinal accessory.

Accompanying THE SPINAL NERVES, by A. H. P. LEUF, M. D. [Coprighted, 1882.]

# THE SACRAL PLEXUS.

- LUMBO-SACRAL CORD, FIRST SACRAL, SECOND SACRAL, THIRD SACRAL, AND PART OF FOURTH SACRAL.
  - **SACRAL PLEXUS.**
    - MUSCULAR.
      - Pyriformis.
      - Obturator Internus.
      - Levator Ani.
      - Gemellus Superior.
      - " Inferior.
      - Quadratus Femoris.—ARTICULAR.
    - PUDIC.
      - INFERIOR HAEMORRHOIDAL.
        - MUSCULAR. — External Sphincter Ani.
        - CUTANEOUS.
        - COMMUNICATING.
          - To inferior pudendal.
          - " superficial perineal.
      - PERINEAL.
        - MUSCULAR.
          - Transversalis Perinei.
          - Erector Penis.
          - Accelerator Urinae.
          - Compressor Urethrae.
        - ANTERIOR SUPERFICIAL.
          - *Muscular.*—Levator Ani.
          - *Cutaneous.*
        - POSTERIOR SUPERFICIAL.
          - *Muscular.*—Sphincter Ani.
          - *Cutaneous.*
          - *Communicating.*—To inferior haemorrhoidal.
      - DORSALIS PENIS (OR CLETORIDIS).
        - MUSCULAR. — Transversalis Perenei.
        - CUTANEOUS.
        - NERVUS CORPORIS CAVERNOSI.
        - COMMUNICATING. — To sympathetic.
    - SMALL SCIATIC.
      - INFERIOR GLUTEAL—(MUSCULAR.) Gluteus Maximus.
      - INTERNAL CUTANEI.
      - INFERIOR PUDENDAL.
      - ASCENDING CUTANEI.
      - LESSER CUTANEI.
      - COMMUNICATING.—To short saphenous.
    - GREAT SCIATIC.
      - ARTICULAR.
      - MUSCULAR.
        - Biceps.
        - Semimembranosis.
        - Semitendinosis.
        - Adductor Magnus.
      - INTERNAL POPLITEAL.
        - ARTICULAR.
          - SUPERIOR INTERNAL.
          - INFERIOR "
          - AZYGOS.
        - MUSCULAR.
          - Gastrocnemius.
          - Plantaris.
          - Soleus.
          - Popliteus.
        - SHORT, OR EXTERNAL, SAPHENOUS.
          - JOINS COMMUNICANS PERONEI.
          - CUTANEOUS.
          - SIXTH DIGITAL.
          - COMMUNICATING.—To musculo-cutaneous.
        - POSTERIOR TIBIAL.
          - MUSCULAR.
            - Tibialis Anticus.
            - Flexor Longus Digitorum.
            - " " Pollicis.
          - PLANTAR CUTANEOUS.
          - INTERNAL PLANTAR.
            - *Muscular.*
              - Flexor Brevis Digitorum.
              - Abductor Pollicis.
            - *Articular.*
              - Tarsal.
              - Metatarsal.
            - *Cutaneous.*
            - *First Digital.*
              - *muscular.*—Flexor Brevis Pollicis.
              - *cutaneous.*
            - *Second* "
              - *muscular.*—First Lumbricalis.
              - *cutaneous.*
            - *Third* "
              - *muscular.*—Second "
              - *cutaneous,*
            - *Fourth* "
              - *communicating.*—To fifth digital.
              - *cutaneous.*
          - EXTERNAL PLANTAR.
            - *Muscular.*
              - Flexor Accessorius.
              - " Brevis Pollicis.
            - *Superficial.*
              - *fifth digital*
                - communicating—To fourth digital.
                - cutaneous.
              - *sixth* "
                - communicating.—To deep branch.
                - muscular.
                  - Flexor Brevis Minimi Digiti.
                  - Third Plantar Interosseous.
                  - Fourth Dorsal "
                - cutaneous.
            - *Deep.* — *Muscular.*
              - Adductor Pollicis.
              - Third Lumbricalis.
              - Fourth "
              - First Plantar Interosseous.
              - Second " "
              - Third " "
              - First Dorsal "
              - Second " "
              - Third " "
              - Fourth " "
              - Transversalis Pedis.
      - EXTERNAL POPLITEAL.
        - ARTICULAR.
          - ACCOMPANYING.
          - RECURRENT.
        - CUTANEI.
        - COMMUNICANS PERONEI.
        - MUSCULO-CUTANEOUS.
          - MUSCULAR.
            - Peroneus Longus.
            - " Brevis.
          - CUTANEOUS.
          - INTERNAL.
            - *First Digital.*
            - *Third* "
            - *Cutaneous.*
            - *Communicating.*
              - To long saphenous.
              - " anterior tibial.
          - EXTERNAL.
            - *Fourth Digital.*
            - *Fifth Digital.*
            - *Cutaneous.*
            - *Communicating.*—To short saphenous.
        - ANTERIOR TIBIAL.
          - MUSCULAR.
            - Tibialis Anticus.
            - Extensor Longus Digitorum.
            - " Proprius Pollicis.
          - EXTERNAL OR TARSAL.
            - *Muscular.* — Extensor Brevis Digitorum.
            - *Articular.*
              - *tarsal.*
              - *metatarsal.*
          - INTERNAL. — *Second Digital.*
            - *communicating.*—To third digital of musculo-cutaneous.
            - *cutaneous.*

1.62½ 8.25
3.25 1.650
1.625
50

x' a mere theoretical anatomy, a closet anatomy would be of but little use in the very practical life yours - Its value is in the application. The knowledge of the human frame, so that we can relieve it of its ills, & restore to their proper function parts which are broken or injured. The anatomy of the present day is an applied anatomy. A living practical knowledge of the human structures. American Surgery which has gained such world wide distinction, has gained it from the practical teaching of our science, after the manner first practiced in this school and still followed and improved. A knowledge of the Human Machine is necessary absolutely so, for success in the practice of our Profession. The more fully & thoroughly acquainted the Practitioner with the human structure the more masterful and successful will he be. A better man worthy of confidence and having a grander reputation. Whatever of his having a fine piece of machinery, as a steam engine or a watch, which he needed to repaired would choose a good mechanician, one who understood the structure of the machine. How much more so then with us in our Profession.

W.H.P

^ which I shall endeavour to teach you here -
- Which will be taught you with every possible care and attention in the dissecting room and in the recapitulations and demonstrations from this place

The last great advance which has been made in our times, ^ is even now in the rapid process of [illegible] ~~the cell doctrine of Schleiden~~ They have shown us that even the general tissues & membranes of the body can be reduced into a congeries of cells, so minute as to be invisible to the naked eye yet each endowed with vital powers peculiarly their own - That the active portions of the blood itself are composed of white & red [illegible]

[illegible]

The usual field in which man prosecutes his various studies, is outside of & beyond his own organisation — It is composed of the different objects which he observes without & around him

In the mountain, in the valley, in the rocks of which the mountains are built, in the vegetable growths that cover them, or the animals that they feed Even the Stars of heaven that shine upon them. His own internal organisation, by which, all this is accomplished, is a thing apart, & of more subtile essence

My own pleasant duty here, will be to make you, so far as I will can, familiar with the structure of our own frames of those very organs by which we carry on our investigations of all outer things

This duty which we have before us, must therefore be an interesting and perhaps even, a somewhat difficult pursuit

But it is nevertheless, so important a one, and so pregnant with deep interest, that there is scarcely any one that does not become enamoured with it in the end

Pure descriptive anatomy, which has been gradually built up ~~from~~ for the last 2 or 3000, years, was almost completed for us by Albinus, in the last century. The Study of that simply, would be necessarily a dry one, Haller connected the Study of Anatomy, with Physiology Morgagni with Pathology — Bichat the greatest genius perhaps that has ever graced our profession in the grand doctrines of membranes & tissues that we call general anatomy, threw wide open the doors to a fast field of improvement in our Science — Hedin almost within my own, but I have never seen him — than seen his Native earth Lisfranc Malgaigne, Richet & a host of others, have shown anatomy in all its relations to the practice of medecine and surgery This in its completed state is the anatomy of the present day, full of general interest — full of direct practical — This is the anatomy which I shall endeavour to teach you here — Which will be taught you with every possible care & attention, in the Dissecting room & in the recapitulations & demonstrations from this place — Can there be a doubt at what point of this great study, I should commence

There hangs the the representative of the

Miss Macmanus

body in all its parts – Blood vessels the thorax abdomen & extremities – the bony frame work, upon which all the soft parts are hung – This we are to study in itself – is an initial step – then we are to clothe it with muscles to endow with bloodvessels – Brain & nerves and with the external & internal organs of sense, ~~this~~ when this is done we shall have demonstrated a perfect structure, which if endowed with life is we know to be fit for all the sensory functions of life as well as fit to eat

Capers in a ladys chamber
To the lascivious pleasings of a lute –

in the curriculum of our school are of importance, in all the departments of medicine & ~~in surgery~~ anatomy is the foundation. What confidence could a patient place in a physician who is ignorant of the patient's structure that he proposes to handle with medicaments or displace & disturb with instruments. Who of us owning a delicate piece of machinery as a watch or microscope but would take it to the mechanician who understood the mechanical structure -

It is also in itself a fascinating study - the knowledge of ourselves, all our ordinary information comes to us from without through the medium of our senses as supported by our anatomical structure - Anatomy is the study of the structure itself

If you will patiently endeavor to master what I will teach you during the term you will find your knowledge increasing day by day - until at the end of the course you will be astonished & gratified with the amount of knowledge you have acquired -

You come fresh and vigorous from your commencement, ready with renewed energy to devote yourself to the mastery of anatomy, I have also matured purposes of your. and I have been devoting over 2 months improving my course & lectures, and to make them clearer in the pure anatomy so that you may more easily ~~grasp~~ master the subject -

Dear Bill –

I want to have a word with you, some time to day. When you are disengaged send word over to the house & I will come over & see you –

Your Brother
"Al"

Sep 27th/9 –

MH Pancoast

1874-75. 75-76, 76-77, 77-78
78-79. 79.80 –

Welcome [illegible] – proud of the attain-ments, [illegible] classes have shown, and of the praise our graduates have received
and I trust that you gentlemen will not consider it a lighter, [illegible] study [illegible] of any [illegible] in your future practice
The knowledge of the structure of the human system that you possess [illegible] of im-portance [illegible] – for which all the departments

On my first appearance before you, as your
chosen expounder of the great doctrines of
human anatomy, and about to ask you to pass
with me over the threshold into the very penetralia
of that great temple of Science ^the anatomy now forms^ which has been
more than 2000 years in building, can there be a
doubt or a question as to the portion of the subject
which I should take for my initial lecture
— There hangs the last ~~representation~~ ^relic^ which the human form
clothed ~~with its muscles blood vessels & nerves~~ ^as we know it & animated with life^ leaves behind it
— There it hangs, the carpentry or frame work, about
which all the beautiful muscles blood vessels & nerves
have been gracefully & symmetrically arranged, a representation
of every portion of the human frame — Head — neck
trunk & extremities — This Human Skeleton must
of necessity be the first object of our study — This human
skeleton the rawhead & bloody bones of our childhood — an object
~~still~~ of abhorrence to the ignorant & vulgar of ~~all~~ ^former^ ages, is found
on investigation to be an object of such great interest &
importance ^as to be now a subject in all our schools [illegible] & [illegible] taught in our public Country schools [illegible]^ [illegible] [illegible] [illegible] [illegible]
[illegible] ^[illegible] [illegible] of [illegible] [illegible]^ — to read it correctly [illegible] a
subject dry & tedious is to me always a matter
of regret

A course of
Anatomical Lectures
delivered at the
Jefferson Medical College
Session of 1844-5
By
Joseph Pancoast M.D.
Prof. of Anatomy (descriptive and surgical)
Written out from
Current notes
By
Edward R Squibb

Vol. 1.

# Lectures upon Anatomy
## Delivered in The Jefferson Med: College
## By Prof: Joseph Pancoast.
## Session of 1844–5.

Novem. 11.
Lecture 1st

Thus leaving out teeth, Hyoid & Ear bones we have 197.
Spine – 26,
Skull 22
Ribs & Sternum 25
Upp. Ext 64
Lower " 60
197
Os Hyoid 1
198.

Some throw out the 32 teeth & 6 Ear Bones & os Hyoides as having no bony connection with the Skeleton

As in anatomy the bony System forms the ground work upon which all the other Structures are erected, it necessarily forms the first subject for our consideration and therefore the proper one for an introductory lecture to the study of this branch. – have been taken by gen^l. Anat. as the basis of classification & they represent every portion of the body

The number of bones in the human body has been variously computed by different authorities; some making them number as high as 252, others 242, and 240, & others only 197 220 This difference, which at first sight might seem to be of such easy adjustment by simply counting the Bones, results from the different periods of life which the different authorities have taken as standards as well as the ~~difference in individual Specimens.~~ throwing out or keeping in the list such bones as

This will be at once apparent by a view of this series of fœtal Skeletons 8 in number, and an examination of the difference in the number of the bones between that at 3 mos and progressively up to the full term of gestation, at which period many which were before distinct bones will be found to have coallesced to form those of a larger and more complex character; this Coalition [sic] takes place in some instances throughout all periods of life, thus giving rise to the differences in question. The symetry of the bones upon the two sides of the Skeleton is worthy of notice, there being few exceptions to it throughout; in so much that a description of those upon one side, adapts itself exactly to the other, and is expressed by the same terms. Those which do not exist in pairs, generally lie upon the median line, and have symetrical sides, examples of which we have in the sternum, vertebræ & Spine &c. So that by dividing the body exactly in two we are able to carry out the idea, and say that an exact description of one half will apply itself exactly to the other,

This will apply as well to the soft parts as to the bones, and those bones, muscles, vessels, nerves &c which do not naturally exist in pairs, have had appropriated to them

With the exception of ...

Cut across opposite the navel the upper & lower halves of the Skeleton are not equal in weight

distinctive names by which this peculiarity is expressed as the Basilar Artery, Azygos vein,
The Bones as the Carpentry or frame work of the body upon which the muscular, ~~xxx~~ vascular and nervous structures are built, ~~&~~ are necessarily of various shapes and dimensions, in accordance with the offices which they perform, Thus we have the ossa lata or flat bones as the Sternum, Scapula, ilium, Bones of the Cranium &c which are formed to give support and extended insertion to muscles, and more particularly to protect the important parts which they enclose; the ossa longa, ~~or~~ long, ~~bxxxx~~ or Columnar bones which act as levers by which locomotion and other functions of the economy are performed, from the manner of insertion of the various muscles onto them, some of them acting also as Columns by which the body and its parts are supported in their relations with each other and with surrounding objects; these are distinguished as well by their structure as by their having greater length than breadth; consisting of a compact circular, prismatic or oval body, having a canal in its centre; thus some of the phalanges come under this head, from their structure although they ~~have~~ really as great a breadth as length. Thirdly, we have the ossa crassa or thick bones, as those of the wrist, anchles, Spinal Column &c, ~~destined~~ designed to ~~give~~ permit a multiplicity of joints, or ~~freedom~~ great variety of motion, at the same time that they afford a firm support to the structures with which they are connected, Besides this division there is another by which the whole body for purposes of arrangement and description, is divided into parts or sections, as the head and neck, thorax, abdomen, pelvis and upper and lower extremities, After these general observations we may proceed to consider bone in its ~~collective~~ individual capacity, after which when studying them ~~individually~~ I shall endeavour to render what I may have to say more interesting and attractive by treating upon the pathology of the structure in connection with their uses, as students are always prone to give less attention to osteology than it should receive from its being the starting point for the study of all the other structures to which it bears such intimate relations,

To answer that question 34

We shall then consider bone in four points of view
First its Physical properties, [intimate structure] Secondly its Chemical
Composition, ~~Thirdly its internal~~ Structure, and
~~Fourthly~~ 3rdly its growth and development, in all of
which I shall try to be as perspicuous as possible,
First then it is hard and dense, qualities which it
possesses to an eminent degree in comparison with
other tissues of the body, having a specific gravity
nearly double that of water; [In fact it is always the only part of the body that [illegible]] In the dead bone as
you see it here, it is of almost pearly whiteness; this
is however, in a great degree due to the processes of
maceration and bleaching which have their effect
to a different degree in different specimens, ~~occurring~~ depending
~~from~~ the difference in the ages of the subject, as it
is only from those in middle life [& the middle life is the common age of the [illegible] from 35 to 45] that the whitest
specimens come, for macerate and bleach as you
will, you can never bring the bones of a child to this
chalky whiteness, they always have this bluish, dark
appearance; and the same may be said of [those] very old
subjects, [will have a dull yellowish tint from the fat placed in their altered cells.] As it is however of more importance to become
acquainted with its appearance in the living than in
the dead condition let us for a moment examine it
as found which still holding its ordinary relations
and as you see it is of a dull or dirty [very dull] white colour
from the animal matter with which it is associated
[It is insensible it is elastic - Everybody knows that a [illegible] common [illegible]]
Secondly, if we subject a bone to long continued
maceration in dilute muriatic acid you render it as
you see this has been rendered, [it thus [illegible]] flexible and soft to a
degree that will admit of its being tied into a knot,
Its shape being the only physical property which remains
unaltered, What has happened to this bone? What
have we removed from it to render it thus elastic [flexible] and
spongy? Simply abstracted all the [earthy] inorganic matter
which entered into its composition, by the affinity
which has been exerted between it and the acid used,
On the other hand place a bone in the fire and
incinerate it, then what happens? we still have
its shape retained, but instead of being pliable
and capable of being bent at will, it snaps like
a pipe stem, and crumbles between the fingers; if we
expose it further to the fire it will not change even
through such exposure be protracted, whereas if we

[Margin: 2. Chemically - And thus it is important to you as a surgeon - for in chiselling away dead bone in the living subject - you want to know the living bone from the dead - & this you can tell by examining the pieces - It is insensible [illegible] healthy as a block [illegible] This we [illegible] when [illegible] the patient [illegible] [illegible]]

expose the subject of the other experiment to maceration in water it will putrefy and burn up. [you place it in the fire it will] Now in the last case we have simply removed the combustible animal matter, leaving the inorganic and incorruptible part entire. [This shows then that there are two conditions in the bone animal & earthy] These two together are constituted according to the analysis of the celebrated Berzelius of the following ingredients in the proportions named.

| | |
|---|---|
| Gelatin | 32.17 |
| Vessels | 1.13 |
| Sub- or Neut. Phos. of Lime (tribasic) | 51.04 |
| Carb: of Lime | 11.30 |
| Fluate of Lime | 2.00 |
| Phos: Magnes | 1.16 |
| Free Soda & Chloride of Sodium | 1.20 |

Schreger has stated, that in the bones of a child the earthy matter constitutes one half — in the bones of an adult [a little past middle life] — four fifths " " " " of a person seven eighths of the whole mass.

with a little Iron and according to some authorities, Silex. [Salts of Soda ammonia] With the whole of this formula I would not wish to tax the memory of the student as it is not of a great deal of practical importance, I will therefore give you one which is much easier remembered, and is sufficiently exact for all ordinary purposes; if therefore you will recollect that it consists in a man [of] one third Animal matter and two thirds earthy, it will be all-sufficient.

But from It must not be supposed that the composition never varies from this formula, for on the contrary it is constantly varying with the different periods of life, for instance in the child you have a greater abundance of animal matter and less earthy, [Schreger says ½ of each] which accounts for the fact which you will often see illustrated in practice, namely, that the bones of Children are subject to be bent by force which applied to adult bone would have caused fracture, and when fracture does take place in the former, it is almost always [frequently] only partial a part of the bone being bent and the remainder splintered and the tenacity with which they hold this acquired position is sometimes surprising, the utmost reasonable force which the Surgeon may apply being often inadequate to bring them back into line, I have in this amphitheatre been obliged to place a bone in this condition over my knee thus, before I was able to get it into its normal direction. Also in Cases of Rickets and some Cases of Scrophula [where the earthy matter once deposited has been taken away] we have this condition of bending developed to an inordinate degree, giving rise to various deformities as crooked arms legs &c. all from an

1. In old persons when a tumor grows & then is carried — it will [illegible] when tumor is removed

excess of the animal constituents in proportion to the inorganic, In old age however, we see the reverse state ~~ab~~taining, here the earthy matter is in excess assuming an analogy to the burnt condition of the bones; hence as we frequently see in very aged persons a simple trip over the carpet will snap off the femur or thigh bone, and give rise to fracture when under circumstances of ~~adult~~ younger age, no inconvenience would have occurred, This condition ~~of~~ sometimes occurs as a disease or an idiosyncrasy, and is then called Fragilitas ossium, ~~a~~ case to the point, of which just now occurs to me of a patient who is obliged to move with the greatest caution to avoid a fracture of some of his bones, which frequently occurred from such trifling causes as getting out of his vehicle, and the facility with which these fractures unite shows no diminution in the organization or vascularity of the parts, So much for Chemical Constitution, We next come to the Internal Structure of bones, which is seen when the bone [is] sawn in two before studying which however we will look for a moment at the arrangement of some of these long bones with regard to their adaptation to their respective purposes, thus we see them greatly increased in dimensions at the joints for the purpose of giving a firm~~ness~~ basis for motion by the increase of space, (and also to serve act as trochlea over which the tendons of the muscles act with increased power,) and this too without any increase in weight, for the increase in size is found to be counterbalanced by the increase of cellular or spongy structure over that which exists in the centre or narrowed portion of the bone, a measured inch in length of the one being exactly equivalent in weight to the same length ~~of~~ of the other, the compact portion, which in the body of the bone is of considerable thickness, being towards the end reduced to a mere shell. This without reducing by the smallest degree the strength of the bone, fulfills also another very important indication as first noticed by Dr Physic, namely, that of reducing the liability to concussion of the brain and other important organs in falls upon the feet. This fact he was in the habit of illustrating by a~~x~~ series of suspended ivory balls as you see here, Now if I draw off one of these balls and let it fall against the line formed by the others

The cellular spaces at the same time becoming more & more filled with fatty matter.

Fact that ends of all bones have an internal spongy portion —

of the series, you see that by a transmission of the momentum the farthest or ~~digital~~ distal ball will be driven to nearly the same distance from the others as that through which the first one fell; now if we replace one of these centre balls by one made entirely from the spongy structure of a vertebra, the momentum is almost entirely lost, the last ball scarcely moving from its position; if we now replace this spongy ball by the body of a vertebra, consisting of compact as well as spongy structure you see that motion or momentum is transmitted more freely, although to no great extent, Such then is their action even though the bones are in a dried state and want that elasticity which the animal matter and vitality gives to them, Now we may very readily conceive of the influence which these spongy expansions at the joints and the spongy character of the vertebra may exert in limiting these concussions, and form some conception too of the great perfection of the works of nature in the construction of our bodies. When we come to look at the internal structure of the long bones, which at first sight would appear to be solid as though cast in a mould, we are first attracted by the existence of a canal which exists throughout the shaft of the bone which toward the ends is surrounded first by a loose cellular tissue of bone gradually increasing in density to the reticulated and lastly to the canaliculated structure, so called from being traversed by multitudes of small canals $\frac{1}{20}$ of a line in diameter, first noticed by Clopton Havers and hence called canals of Havers, This large or medullary canal as it is called does not extend into the sponge ends of the bones, but is lost as the cellular structure is increased to form these expansions, — As it was necessary to the required strength of these bones that they should have a certain diameter which with the same quantity of material, greatly varies the strength or capacity for sustaining weight, as may be at once proved by the greater weight which will be supported by a strip of paper when rolled into a number of cylinders than when existing in a single one, — this canal was left in order to accomplish this increase of strength, and Nature who never leaves a cavity unoccupied, or without turning it to some

Bones are strong — They have been proved by experiment
to have twice the strength of a piece of solid oak of the same
dimensions — [illegible]
[illegible]
[illegible]

Division of bone into compact & spongy — The spongy
subdivided into reticulated & canaliculated in the long bones
— While the compact portion is really little more than the
spongy portion compressed with the cells effaced —

useful account, made of it a place of deposit in which to store up the products of digestion, which already highly animalized are kept in readiness together with the fatty deposites in the omentum and other parts of the system, for some sudden emergency, as starvation, some reducing fever, or
Some cachexia, which interferes with nutrition
~~other misfortune~~, in which case the economy as it were ~~preys~~ feeds upon itself. There is a great diversity of opinion with regard to the intimate structure of bone, some authors considering it as fibrous or laminated, others classifying it into cellular, reticulated and cancellated, solid or compact textures according with the microscopic appearances of cells and canals; but it may all be regarded as cellular or spongy, and be illustrated in all its varieties of density by this simple peice of sponge, which if I stretch to its utmost extent, thus, exhibits the cells of its structure large and open, whilst if compressed in this manner these will be shut up from observation, and the tissue be more compact, although they still exist with diminished capacity. Some too have considered the tissue of bone to be fibrous in its character, and much time has been spent in ~~de~~ endeavoring to determine the course and direction of these alleged fibres. This appearance however has arisen from the direction of the minute canals giving to the softened bone a greater tendency to separate in some directions than in others as is demonstrated by the facility with which this one is torn. We may for these reasons rather liken the structure of ~~the~~ animal part of bone to this sponge
the cells of which by receiving an incrustation of earthy material would become hard and firm. the necessity of such an earthy incrustation is very apparent; Thus if my humeral bone consisted entirely of animal matter the contraction of the biceps and the other muscles around it would not enable me to raise that skull without bending it entirely out of its line of action; whilst on the other hand if it consisted entirely of earthy matter these contractions would snap it asunder, before the execution of a single act of volition. I have not as yet spoken of the arrangement which exists in the bones of the cranium. They have also a ~~firm~~ an strong outside table as it is called, and ~~an~~ an inside or vitreous table which is thin and as its name

The tables of flat bones being analogous to the compact portion of long bones — the diploe, to the spongy or cellular

imports, very brittle from the superabundance of earthy matter, in so much is this the case that a blow which leaves the outer table unharmed will often cause fracture of this inner or vitreous table; the space between these plates is filled with spongy structure not differing from that of other bones except in the size of the canals for the venous blood which are here called sinuses although they differ from ordinary veins only in having their outer coat replaced by the bony canals which they fill; these are very numerous and some of them quite large, so that in operations like that which you saw performed by Prof. Mutter of trephining, they are liable to be cut, and being in a bony enclosure cannot be taken hold of, and tied, but must be stopped by plugging as was done in that instance. Arteries also ramify here in great numbers, but of much smaller size than the veins, in fact this diploe or meditullium as it is here called is ~~composed~~ made up almost ~~of~~ wholly of vessels as may be seen by this beautiful specimen of a skull injected with coloured size, from which the outer table has been removed by rasping, as also by these plates taken from Breschet's beautiful work upon the venous system.

The next question which occurs is, are bones organized? and we say without hesitation that they are, and for these reasons; if you scratch a bone, it bleeds; if you cut it, if you break it, it heals (granulates); if you burn it it dies; in short it has all the attributes of organization but one, and that is sensibility, for when healthy bone is injured there is no sense of pain. This probably arises from the fact that the sympathetic system of nerves which especially governs the circulation, is except when an exaltation of function takes place from inflammation, totally devoid of ordinary sensibility; this difference in the source of innervation is probably the only one which exists between ~~the~~ bone and the soft parts which surround it. The next question is by what means does this organization take place? In what state ~~How~~ does this earthy matter exist in connection with the animal? and how is it deposited, in short how are bones developed and how do they grow? With merely showing

you a magnified representation of what are called the bony corpuscles, and the cells which they form and connect I shall close this lecture, reserving for the next meeting an examination into this part of our subject

Lecture II.

After having considered at the previous lecture the Physical Characters, Chemical composition and internal Structure of bones, we may now proceed to enquire into its mode of organization, growth and developement; that it is organized must be apparent from what was said at our last meeting, as well as from the numerous specimens upon the table before you, In the one which I hold in my hand, one of the attributes of organization is very evident, namely the distribution of blood vessels to it, which have as you see been minutely injected with coloured size, and from disease we have evidence of the other attribute namely, the distribution of nerves, the sensibility, as before remarked being very acute under diseased conditions, The next point is, how do these blood vessels get into the structure, In the examination of any dried bone, multitudes of foramen will be observed by the naked eye, which communicate with the spongy structure inside, where there exists plenty of room for the ramification of the vessels and nerves which these transmit, and so multitudinous and minute are these ramifications, that when injected, the whole spongy tissue seems to be dyed of a red color, We know also that the canals of Havers exist, although so small as to escape the unassisted vision, and that these canals not only convey vessels and nerves, but contain also a quantity of fatty matter by which these are surrounded, and communicate with the surfaces of the bones by orifices which although exceedingly minute, nevertheless serve to convey vessels from the circumference towards the centre, There is in addition to these, to be found in all bones what is called their nutritious foramen through which an artery of considerable size with a nerve from the sympathetic, and probably absorbent vessels pass to gain the interior of the bone, In the thigh bone which I hold in my hand, you see there exists two of these foramina, which have this peculiarity, namely that whilst those of all other long bones of the lower extremities penetrate their substance obliquely from above downwards, those of the thigh enter

Nodes are an affection of the Periosteum — 3 varieties of nodes — Elastic, Phlegmonous & plastic — The doughy or elastic nodes, give to the hand the sensation of confined gum & are the result of the ~~thick~~ effusion of a thickish fluid under the Periosteum — they are generally painless, fluctuating & tend to resolution. this variety is easiest of cure, & least painful — The Phlegmonous are preceded by infl: action — give exquisite pain & mostly suppurate — the pus accumulates between the bone & periosteum — The Plastic nodes begin like the doughy or elastic; but are more painful — Skin unaffected — the tumour is at first fluctuating — afterwards acquires a little consistence — gets gradually hard — passes through the diff. stages of plastic sarcocele, & at last emerges into ossification & eburnation. It now forms a species of exostosis resembling an epiphysis — {There are two kinds of exostoses — one resembling an epiphysis & one Parenchymatous — In the 1st kind a plastic effusion occurs between the periosteum & the bone or within the cells of the periosteum — The Periosteum gets a little thickened & shows a tendency to lose its connection with the bone — by the infiltration of lymph into its intimate texture — the effused matter becomes thick, undergoes a strong transformation then turns to cartilage which becomes the nidus wherein new bone is generated — & now this is sooner all we know about the formation of bone — What do we know now? (2) Parenchymatous exostosis is that generated within the substance of bone itself & is the result of osteitis — the compact portion of bone is that affected — (the spongy in strumous osteitis). Great pain in parenchymatous osteitis or exostosis — there is a sort of strangulating sensation; swelling of the bone & great calcareous deposits within the diseased bone: this deposit first lymph, then bone, takes place between the natural fibres (or cells) of bone. this deposit of phosph. lime becomes at length too bulky for the space, gets atrophied or destroys the adjacent plasticity, structure & remains stationary, this constitutes the stage of eburnation & makes an ivory exostosis Ricord, Lancet Aug. /48.

from below upwards, To understand this apparent anomaly, it is only necessary to understand the position of the foetus in utero, whose thighs are flexed upon the body, whilst the legs are flexed upon the thighs, so that gravitation which greatly aids the circulation in early periods of organization, must act equally in both cases, whilst if the other arrangement had obtained, one of its courses would have been against gravity".

I think it is rather the direction of the blood vessel, than gravitation —

The vessels which these foramina transmit are improperly called the nutritious arteries of the bones, incorrect because they are ~~rather~~ concerned in the deposition of the contents of the medullary canal and spongy structure as well as those in any modification of the bone, there existing a peculiar set of vessels for this purpose, which externally ramify upon an investing membrane peculiar also, and common to all bones, called the periosteum, This membrane is of a fibrous character, bearing great analogy to the dura mater of the cranium and was supposed by the older anatomists particularly those of Arabia from whom the idea came, to be only an extension of that membrane reflected along the nerves to the bones, It is closely adherent to the bones by the intermediation of short fibres of cellular tissue and minute vessels for which it forms a bed or nidus in which to ramify and divide before entering the minute pores, This membrane covers every part of the bones except the articular cartilages, giving to them a complete investment or sheath, upon which are inserted all the muscles spoken of in the books as being inserted into the bone, for they none of them touch it except by the intervention of this tissue, - at the articular surfaces of the bones which are tipped with cartilage this membrane is reflected over the capsular ligament of the joint to the bone with which the first is in apposition, to the investment of which it then goes, - when the bone joins itself to a cartilage as in the case of the ribs it is reflected upon this cartilage and then takes the name of perichondrium, and if we were to coin a word for the reflection at the joints it would then be peridesmium, It may be very easily demonstrated as a distinct and very vascular membrane, by stripping it off the

bones as you see has been done in a number of instances upon the specimens before you. Beside this external periosteum, we have another membrane very much concerned in the growth nutrition and development of bone, which is called internal periosteum endosteum or medullary membrane from the fact of its lining the medullary canal, This as you may see by this section of the tibia of an ox, which has been chosen on account of vessels being highly injected with blood from the animal having been killed by a blow upon the head, this producing a congestion of the smaller blood vessels This specimen very well serves to exhibit its exceeding delicacy and vascularity, being formed of a light gossamer like cellular substance, in common with the cells into which the fat or marrow is deposited, each cell of which is furnished by an artery, vein, nerve and probably an absorbent vessel, This is the tissue upon which depends those deep seated pains in syphilis, and analogous affections, and serving as it does to nourish the internal structure of the bone, its separation in consequence of the obstruction of its support in the removal of the fatty matter which takes place in the altered condition of nutrition in scrophula &c, gives rise to what is called internal necrosis, or a death of the internal part of the bone which depended upon it for nourishment; this condition we often meet with particularly at the Phila Hospital, where we have so much to do with diseases of the bones, and I believe it entirely depends upon this removal of its supporting fatty matter, in consequence of which a slight blow upon the limb is sufficient to detach it upon which necrosis or death of the bone necessarily follows, One practical fact observation with regard to the entrance of the large artery and nerve through the nutritious foramen in the bones has not been noticed namely, that of accounting for the fact that sometimes in the operation of amputation we have a severe pain felt upon sawing through the bone, whilst in ordinary cases, no sensation whatever is experienced save the jarring of the saw, for instance when we perform the ordinary amputation of the leg, we cut through the tibia above the nutritious foramen

whose direction in that bone it will be perceived is downwards, hence we do not cut the nerve, with the saw and and therefore give no pain, whereas if the operation is performed lower down, or below the foramen, the saw must come in contact with the trunk of the nerve, and therefore give rise to a severe paroxysm of pain, We are now prepared to take up the subject of the growth and developement of bone, upon which however interesting it is, as there is no practical value attached, I shall not dwell at any great length,

1st of the Development of bone

Microscopic examinations have taught us the probability of all living matter being propagated by Cell germs, And a celebrated microscopic examiner Raspail has exclaimed, "give me a single cell germ and place it in an ovary and I will raise you up a perfect man" ~~This~~ ardor for such examinations and discoveries has however carried its votaries too far, for the assertions which have been made by them in their warmth, are many of them unproved and perhaps improbable; This however is I believe is pretty well ascertained, that the rudiments of

drop of mucus

man consist in a drop of mucous, which under the prolific endowment of life is fashioned out progressively into the perfect being, This progression is admirably exhibited in this series of foetal Skeletons,

Skeletons

In this one at the ~~2d~~ 3rd mo of utero gestation, you see the frame work is already modled out, although it has not as yet in some parts even the consistence of cartilage, but consists in a jelly like substance, without joints, which would entirely and immediately dissolve in water; from this then the progression towards the perfect bone takes origin

?

About the from seventh to the ninth week after ossification cartilaginous [illegible] the first approaches towards a in the clavicle & jaw bones

ossification

Cartilaginous character is distinguishable, Shortly after which ossification of some of the bones, is seen to commence, and in the order in which this takes place ~~the~~ omniscience of the Almighty Ruler is clearly shown, for it does not commence in all parts of the body at once, as might be supposed, - but in the order of necessity and that is the only order of classification which

order of ossification

can be adopted to express its commencement; thus the vertebra, bones of the pelvis and those of the chest and Cranium from enclosing the most important organs, many of which

113.

are inservient to the development of other parts, are first enclosed, and successively all the rest in proportion as it is required that they should, in order to acquire a certain necessary degree of perfection before the being is fit to maintain and independent existence, We next enquire how does this ossification take place, and how increase? By Cell germs. In the commencement of the process the nidus for the future bone consists in a miniature representation of it in Cartilage, as it is only in cartilaginous structures [Except between membranes as on the Skull] that bone is deposited, — these cartilages being solid, without any canal through them, This cartilage in its approach towards the formation of bone is seen, under the microscope to develope little cells called Cartilage cells or Corpuscles [Chondroplastes], which as the process progresses, are enlarged by the growth of the granules which they contain, until each of these acquires the size of the parent Cell, It is at this point that the true bony structure begins to be formed by the deposite, in the ~~thin~~ dense jelly like substance in which the cartilage corpuscles exist, called hyaline fluid, and in the interstices between these developed cartilage corpuscles of a true bony point or bone corpuscle, — These bone cells [osteoplasts as now called] are gradually increased in size by the osseous deposit, & are multiplied in number, and as they progress are apparently joined together by the irradiation from each of a number of thin projections resembling the legs of a spider projecting from his body; these being hollow and bony are termed the Tubuli Calicophori, As the bone corpuscles are enlarged and increased in number, they exercise a pressure upon the cartilage cells by which these are made to collapse, and in this collapsed or diminished condition they coalesce so as to form when thus joined by the crowding of the Bone corpuscles, the true Haversian canals, towards which all these Tubuli Calicophori finally concentrate, In these enlarged representations made from the late beautiful plates of Gerber and Henley, you see this progression from cartilage to bone beautifully represented, you have here also a magnified representation of one of the canals of ~~Havers~~ Havers in perfectly formed bone, and you may see the manner in which these Tubuli converge towards it and finally terminate in it, — Thus we see that by this deposition of bony matter in the [walls of the] cells, and the incrustation of the tubes an entire bony tissue is formed,

Cartilage is not converted into bone — As well say the bark of the tree is converted into the wood — There are conversions of the [illegible] — cartilage in substitution for [illegible] — Bone is substituted for cartilage

I don't understand the adaptation of bone to produce the medullary [illegible] — they grow on through all life — how are the cells [illegible] Haversian canals enlarged in old age — I think it must be want of renewal of osseous particles — it becomes more different from [illegible] for the reader to [illegible]

[illegible] between the membranes of the Skull — that ossifies — just as the Blastema is formed

and the cartilaginous structure as it were, obliterated and replaced, Now in Rachitis, we find that this bony matter which should be carried by the vessels and deposited in this structure, is by some faulty nutrition diverted from its course into the blood circulating here, and may be detected by chemical agents in the urine, In as much as this deposit of bony matter has been described as taking place from the vessels, you might naturally expect to find it in some condition in the blood, which chemists have done by the use of proper tests and reagents. We next take up for consideration the manner in which bones grow.
In the long bones, the process is commenced by the formation of a bony ring at the point where the nutritious artery enters the bone, enclosing within its circumference the space for the medullary canal, this ring is gradually enlarged towards each extremity. As the child must walk before the bones are finished the epiphyses ossify first. Thus they begin to grow, now what is to limit this growth? This limit is ~~placed~~ determined by a dense layer of cartilage placed between the head and shaft of the bone, which always exists up to the time when the bones cease to grow, when it too becomes ossified, The epiphysis or head being developed from a separate point of ossification this line or layer occurs where this ossification from the two points meet, and in it is deposited all the bony matter lengthening the bone untill it has acquired the standard of size which is determined by the great Director of natures laws, This is another admirable arrangement in the operation of the laws of our economy, in as much as it was necessary to the use of the joints that they should consist of firm bony matter, This could not have obtained if the head pursued the same manner of developement with the body of the bone, it therefore is always developed in a separate peice and has become firm and solid long before the body has acquired its full length, and before the two are fused into one, — as you see in these specimens taken from young subjects, the separation is easily made by simple maceration by which the cartilage is dissolved, All Bones, however, are not developed in this way, The flat ones for instance grow from a single point of ossification from which bony irradiations take place until the whole has become ossified the same form holds good with regard to the thick bones with this difference that the rays or spicula do not assume the form of a plane but proceed in every direction

— There is a blastema poured out between the meninges of the skull — that ossifies — just as the Blastema is poured out in the layer between ~~the~~ diaphysis & Epiphyses

15,

Belchier an English Surgeon dining with a dyer found the bones in a piece of pork on which they dined tinged red — He found that it was caused by the madder that got into the swill — Duhamel & Hunter after experiments by feeding hogs with madder, from this hint —

examples of each of which may be seen in the bones of the Cranium and wrist, in these plates of Tiedemann. Now there are other bones which cannot be developed from a single point, as those of the vertebra, These as may be seen by this beautiful preparation of the foetal bones originally consist of seven distinct peices, from seven points of ossefication which finally coalesce to form a vertebra; the same is the case with the Sternum and many other bones, direct irradiations from the centre of which could not possibly reach all points, The manner of growth in bones is proved by the following experiments, specimens of which you see before you, which were repetitions of those of the celebrated John Hunter, The first by which to exhibit the manner in which bones are lengthened, which before was supposed to be accomplished by interstitial deposit, — was to lay bare the tibia in a young pig and insert upon the surface of the bone two Shot, the one exactly an inch from each end of the bone, and then to measure exactly the distance between them, after which the parts were brought together and the animal fed until he acquired his full size, Upon killing it the Shot were found to remain exactly the same distance apart, but greatly removed from the end of the bone, and were also found to be imbedded in the bone, showing conclusively that all addition to its length had taken place between them and the end or in the line between the Epiphyses and body, — and that addition in thickness had occured upon the outside by the deposition of successive layers from the periosteum, The other experiment was that of mixing madder with the swill upon which a young pig was fed, by which the bones were coloured yellow, the substance acting as a mordant, Some time before the animal was killed the madder was omitted in the food, and upon examination a layer of white bone was found encircling the yellow or coloured portion, showing plainly how the deposition had taken place, — If such was not the manner in which it grew, but simply by interstitial deposit, we should have had the bones presenting instead of their present just proportions, amorphous masses, as broad as they are long, for such deposite must have increased them as much in one direction as another,

Disease sometimes interferes, as in Scrophula, in the limitation

The latest bones to have the epiphysis & Diaphyses solidified are the lower ends of the femur & upper ends of tibia — upper end of humerus & lower end of radius — this last of all

In females all solidification is complete at 22 In males 24 - 5 or 6

If ossification of layer between Epiph. & Diaph. took place too early, there would be dwarfing of the late growth — the lengthening of the bones & the calling of the bone is often caused by weakening of constitution that keeps the junction open too long

of this growth by keeping this line or bed of deposit open longer upon one side than the other, - as has several times happened under my notice, where a depraved condition of nutrition in one limb has been accompanied by a continued accession in the length of the bone, and the patient have finally recovered with one bone really, - and not apparently as is sometimes the case, - longer than the other,

In as much as this subject has now been considered as far as necessary, and there is not sufficient time to enter upon another, we shall defer it until we meet again.

Sect. III

For the purpose of economising time, I am in the habit of describing with the bones, the apparatus by which they are attached to each other, namely the joints, Now of these joints we make three great divisions, each which may afterwards be divided further, First we have the movable joints, called articulations or Diarthrosis which are divided into various classes as the Ball and socket joints, Enarthrosis the most movable of all the articulations, in as much as they move in all directions, this species we call enarthrosis, as the hip joint, The second division of moveable joints are those Ginglymus which can move only in one direction these are the hinge like or ginglimus joints, The third division are those which exercise a sliding motion upon each Arthrodia other, generally entering into what are called compound joints, or those whose motion consists in a number of ~~bones~~ bones each movable to a slight extent as the Carpus and Tarsus, these are called, Arthrodia. There is also another species of movable joint, where one bone rotates upon another as the Radius upon the ulna, The second grand division are the Amphiarthrosis semi movable joints, in which the bones are so united together as not to admit of motion to any great extent, yet are not wholly fixed, examples of which may be seen in the union of the vertebra, Bones of the pelvis &c, that by which the two pubic bones are joined being called symphisis, The third great division is that of the immovable joints, or synarthrosis where the bones are so joined together as to admit of no motion whatever, the bones of the cranium Sutura and the junction of the ossified cartilages of the ribs with the sternum, and the junction of the diaphy

What have we entering into the construction of a joint — Bone — Cartilages — fibro cartilages — Synovial membrane, & fibrous tissue — every thing wears away with friction except cartilage, that does not

-ent bones of the sternum are examples of this class. Now as we know that the bones are highly organized from what has already been said upon that subject we must see that the constant friction to which they would be subject in moving upon each other in the movable joins, would soon develope inflammation if it was not from the protection which is given by a dense, white, shiny material with which as you see the ends are covered. This is called cartilage of which we had occasion to speak when considering the formation of bone, This with which the ends of the bones are covered is however different from that of which we then spoke and is distinguished from it by the term articular being applied to it, It seems to be in fact but the continuation of the cartilage of which the bone was originally formed, ossification having ceased at a certain point short of the entire mould; and this incrustation seems to become thinner as we advance in age, although it is never found entirely ossified even in the centenarian, It consists of minute fibres placed upon their ends, like the fill upon velvet, and we may at once see the advantage of this arrangement when we consider the friction that takes place upon them, it also gives to them an elasticity which is so necessary. These cartilages also possess another very necessary property, namely total insensibility in consequence of which they are so well adapted to bear the weight and friction which is placed upon them, These smooth surfaces are lubricated with a liquid consisting of water ~~fibrin~~ albumen &c which like the oil which is applied to machinery serves to render the motion free and easy, unlike the oil however it never grows thick or rancid, This fluid is called synovia and is secreted by a membrane which surrounds the joint of which we shall have presently to speak, This fluid is strictly accommodated to the use of the joint and furnished in greater or less quantity as the joint may from limited or excessive motion require it, These cartilages with their membranes ~~never~~ go but little beyond the parts which come into apposition, stopping short at the edge of the articulation, The next question is, are these cartilages organized? does it secure

Blood vessels, nerves and absorbents? In this I am induced to coincide with Velpeau, Malgaine and other eminent writers, and think that it is not organized, and for these reasons, first the most minute and careful injections have always failed to penetrate them always stopping short at the junction with the bone, and secondly because the most powerful microscope has failed to detect vessels in it of any kind, These with its total want of sensibility has induced me to reject the idea of its organization, as anatomists should never receive any thing which cannot be demonstrated,
If not organized then how does it live? it is minutely composed, as we have seen of cellular ~~substance~~ structure with a transparent fluid between, now in order to be capable of understanding how it may live, we must first notice the increased number of blood vessels which for its basis, none of which run into the cartilage but just in contact with it, and in a plane with its surface, from which it is doubtless nourished by imbibition or the transudation of the serous portion of the blood through the Coats of the vessels, Another reason for this belief is the partial ~~ossification~~ which it undergoes in old age, showing that in as much as there is always ossific matter floating in the blood, it must be from that source which it takes place, and in this way of exudation because there are no vessels noticed in it even by the microscope, This tissue is however liable to become ~~diseased~~ changed; in which condition the cells dilate or expand, the substance becomes spongy and finally peels off, leaving the white lamina of bone beneath exposed to view, as I have sometimes seen, There are other Cartilages in the body which although not commonly found ossified differ from these in being subject to assume this condition in the later periods of life; these are called membraniform Cartilages examples of which are seen in those of the ribs larynx &c. There are others beside the joints however which are never found completely ossified, as those uniting the vertebra, &c There exists about the joints another very important tissue of which we have not as yet spoken, we have seen how the bones are brought into contact, and the arrangement by which friction is

lessened, and we have next to enquire by what that contact is maintained, - This is accomplished by another fibrous tissue, necessarily of great strength, called ligamentous, fibrous or desmoid tissue, which surrounds the joints in the form of a cap or bag, or is carried from one bone to the other in cords or bands as you see in this lateral ligament of the knee joint, Now there is in Nature no animal tissue of equal strength with this, yet you see it is perfectly flexible, although not elastic, so great indeed is its strength, that in straining injuries about the joints, lamina of bone are frequently torn up by them before they will themselves yield, This same tissue forms the tendons of the muscles, as that of the ~~Plantar~~ muscles of the foot which I show you, - and spread out in the form of a membrane we saw it last evening extending across the lower part of the abdomen as the tendons of the abdominal muscles, so also do we find it forming a general investment of the thigh under the name of Fascia Lata Femoris; It is also essentially the same kind of tissue with the periosteum before spoken of, and with the dura mater of the brain, This is the tissue which is concerned in what is ordinarily spoken of as a sprain or strain, in which the fibres are rarely ruptured, being as I before said rather torn up from the bone, but the principal inconvenience or pain arises from the rupture or contusion of the cellular tissue with which the interstices between the fibres are filled up, Now in as much as this tissue will neither stretch or tear, you might ask how comes it that we have dropsical or purulent effusions into the joints sometimes to the extent of a pint as I have often seen in the knee joint It may be answered that these never taking place suddenly but always by regularly increased deposit, the ligaments ~~have time by acquiring more tissue~~ become softened & yield to adapt themselves to the necessities of the case, and we find that when such collections are discharged these again gradually return to their normal condition, This tissue unlike the last is liberally furnished with blood vessels and probably with nerves also, although its sensibility is not of a very high grade, - probably not under healthy conditions at all sensitive to injuries, This fact was illustrated by the celebrated Percival Pott upon

his own person, Being thrown from his horse he ~~produced~~ suffered a compound fracture of his thumb, by which one of the tendons was exposed, This accident determined him, with his great professional zeal, to put this question fairly to the test, he therefore desired his assistant whilst he looked in another direction, to cut of a part of the tendon, This was done, without his feeling from it any sensation whatever, When attacked by inflammation however, this tissue appears to rise greatly in the scale of sensibility, in as much as at that time the least motion in it produces the most excessive pain, We have next to notice that in as much as these ligaments are not by their nature very smooth or calculated to reduce friction and from the necessity of their being flexible, could not be lined with cartilage for this purpose, - that we have lining them an exceedingly delicate and smooth membrane, highly vascular and nervous and as you may see in this specimen taken from the ox, almost perfectly transparent although so vascular, This membrane is called Synovial membrane from which is secreted the fluid which lubricates the joints, which from be being of a semi vital character is the best possibly adapted for the purpose intended The vessels ramifying upon this membrane are so exceedingly minute as not to admit the red globules of the blood, and their circulation therefore consists of the liquor sanguinous of the blood, which accounts for its transparency, That it is vascular and that to a very great extent, is readily demonstrable in this Specimen where it has been injected by colored thin size, The offices of this membrane are to render the sides of the ligaments smooth and movable, and to secrete this fluid or Synovia by which motion in the joints is rendered so free, - this fluid is always present in the joints, and in injuries ~~about~~ these structures its escape denotes to the surgeon that the cavity has been opened, In former times it was supposed to be secreted by the small masses of fat which are allways found around the joints, and hence these are spoken of as the glands of Havers, but at this time it is referred to its true source namely the membrane

lining the capsule of the joint. These membranes are not however confined to the joints, for they seem to be as it ~~were~~, developed by friction, wherever this takes place throughout the body; Those which as you see in this specimen surround the tendons in thin sheaths, are called theca, Bursal or Synovial sheaths and where they exist as a simple bag or pouch between two parts subject to motion, they receive the name of Bursa. It has been and is taught by most anatomists, that the Synovial membrane of the joints exists as an entire sack or in other words extends over the cartilages of the bones which are brought in apposition; but for many reasons which I shall assign, I have been induced to adopt a contrary belief. Thus I conceive that such a delicate and sensa-tive membrane would have been very much out of place where it would receive such rude compression and friction and moreover injections which fill its vessels with facility where it lines the ligaments, stop short when they arrive at the edge of the cartilage, or, form arches around this edge, as may be seen in this magnified drawing of the specimen which I hold in my hand. Toinbee however in his late work says that he has succeeded in injecting it over the cartilages in a foetus ~~before birth~~ not at full term, and thinks that it bears in them, analogy to the membrana pupilaris, which exists at the same time, but at birth is ruptured, the divided extremities receding to leave the pupil open. This he thinks occurs in the case of the synovial membrane, and his opinion is strengthened by the increased number of vessels which exist just where the cartilage commences, which may have arisen from the recession of those which in the foetal state covered the face of the cartilages. However this may be I have fully satisfied myself by repeated observation that such a membrane does not exist upon the cartilage in adult life. The specimen which I hold in my hand is one prepared from the leg of a patient upon whom I operated at the Hospital some time since for extensive necrosis, — and here by the way, I may exhibit to you what you would probably mistake for the internal periosteum of which I spoke in my lecture yesterday, but which is nothing more than the membrane which lines all abscesses and from which their contents are secreted, called

technically, the pyogenic membrane, — This patient being too much debilitated by the excessive disease to undergo the usual operation at the thigh, I was obliged to remove the limb at the knee joint where in consequence of the scarcity of tissue, I could not get enough flap to cover the internal condyle of the humerus, which was therefore exposed to daily observation for some 10 days, through which I watched in vain for the excessive inflammation which would have followed such exposure of the synovial membrane; On the other hand the cartilage gradually macerated off layer by layer just in the same manner that it would have done in our macerating tubs, leaving a clean lamina of bone below over which the scanty flaps healed without further
from which granulations shot up
difficulty, From these reasons I am inclined to believe that this membrane is confined entirely to the sides
where it has receded after rupture in the foetal state, & may prolong itself again by inflammation
of the joints, There are other structures in the body wherein ligamentous matter is concerned which have not as yet been mentioned, These are the intervertebral ligaments and the coats of the arteries, These consist of a yellow Tissue which differs from common ligamentous structure in its Colour and in possessing elasticity, This yellow tissue called by the french, the tissu jaune, In the complicated joint which the spinal vertebra compose, it was necessary that the cushion separating the bones should be elastic, otherwise no motion could have taken place between them, this elasticity also serving another very important function, namely that of bringing parts back to their former relations, when they have been distended by muscular contraction, after this contraction, The specimen of this tissue which I here exhibit to you is a part of the ligamentum nuchae of the ox where such a texture becomes very necessary, and consequently the characteristics are well marked. This necessity will be very apparent when we consider that ruminating animals as well as all those whose heads and trunks are carried horizontally, — would necessarily have to make continued exertion and keep the extensor muscles of the head and neck in a constant state of contraction to prevent these parts from gravitating and falling between the fore legs

and we know that muscles are not capable of unremitted contraction, they must have periods of repose; and for these reasons such animals are provided with this exceedingly strong and elastic ligament which is fixed to the head and spinous processes of the vertebra by which this tendency to gravitation is overcome, and by which the head is replaced after the muscles have ceased their action, This tissue exists in our species in the vocal ligaments, Ala of the nose and in various other situations, It consists of microscopic cells or rather a reticulated condition of fibres forming cells, the elasticity of which is due to a stretching out or lengthening of these fibres, which when unopposed returns to their natural zigzag condition, There exists also in the involucrum of the penis a tissue analagous to this by which the flow of blood to and from this organ appears to be influenced, We are next prepared for the study of the individual bones, and shall commence with the bones of the head, preparatory to which I shall finish the lecture with a few remarks upon the sutures by which these are connected, Most of these as you see have upon the surface of the cranium a serrated appearance, or appeared to be dovetailed together as the joiners say, for it is a true interlocking of the spicula or processes, upon the inside of the cranium however this is by no means so apparent, and the reasons are very obvious, for as you will remember, I told you that the internal table was so brittle and fragile as to have been called the vitrious or glass like table, and who would think dovetailing glass or marble or any like brittle substance, on the contrary they are fixed by a kind of cementing process just as we would cement these substances, These sutures or seams have received various names from their shape or condition Thus the one joining the frontal to the parietal bones is called the coronal suture from occupying the place over which the ancients wore their wreaths or crowns; that between the parietal bones has been called sagital from its arrow like straightness;

that joining the occipital bone the the others of the cranium from its approximation in shape to the greek letter ʌ has been termed the lambdoidal suture; and those by which the temporal and parietal bones of either side are joined is from its scaly construction, called the squamous suture; there are also other sutures about the head and face which have received other appelations; thus we have the suture by harmonia, by gomphosis and synedisis, at our next meeting we shall go on the consideration of the individual bones of the cranium.

Lect. IIII. In my lecture of yesterday, after finishing the general considerations of the bones and joints I entered upon the consideration of the proper bones of the cranium or rather the sutures by which they are connected, Those with which we now have to be concerned are the coronal, sagital, lambdoidal and squamous sutures to which the older anatomists added another or rather the continuation of the lambdoidal in a different direction between the occipital and the mastoid process of the temporal bone; this the denominated additamentum sutura lambdoidis, This however is of little moment and we therefore shall not take up further time with it. Now why was the cranium made in seperate pieces and connected by these sutures? for it consists of 8 bones in all, two of which, however are considered to be common to the cranium and face both, namely the sphenoid and ethmoid, We sometimes have, it is true, this numbe increased by what are called the ossa triquetra or wormiana, which consist in destinct portions of bone developed in the course of some of the sutures, most commonly the lambdoidal as you see in this specimen, where we have two or three very large ones. A great many heads are without any of these, but in some their number amounts to 10 or 20. Now it is of some importance to recollect the fact of the occasional occurrence of these bones, in as much as the older french surgeons in particular describe

some cases in which a trephine has been applied for their removal after accidents, supposing them to be fractured portions of the other bones. Now suppose a child with a skull such as I hold in my hand, should get a fall or a blow upon this part of the head and any of you were called upon to treat the case, you cut down upon the bone, and without recollecting the occasional occurrence of these sutures, you come upon one of them you would be very likely to say here is a fracture and proceed to raise the supposed fractured portion therefore you see it is necessary to bear them in mind. Why then again has the head been formed of so many bones, and joined by these sutures? This results from the operation of the beforementioned laws which govern ossific deposite namely that radiations in right lines from a single centre, could not possibly reach to every point of the head.
The arched form given to the head by the union of these bones is a condition which at the same time that it offers great resistance to the force of blows, was necessary to the Box like envelope which must be afforded to the delicate organs which it contains. Every one must be acquainted with the considerable force which is required to break the thin shell of an egg from the form in which that shell surrounds it being that which of all is the best calculated to sustain ~~resistances~~ strokes or blows.
The cranium enjoys another means of resistance than that which results from its shape, namely the means by which the parietal bones are united to the squamous portion of the temporal bone, the latter of which as you see overlaps the other to prevent its springing out of place from force applied on the top of the head, thus acting precisely the part of what is called a tie beam in architecture. Thus we see that in such cases of blows upon the head the whole force is transmitted to the base of the cranium, and it results from this arrangement that we have bleeding at the ears, and from the ethmoid cells following such blows without any fracture having occurred, these delicate tissues being ruptured by the transmission of the shock through the bones. Now the older surgeons conceived the use of these sutures

to be to limit the extent of fractures, just as though heads were intended to be ~~fractured~~ broken, This we know is not the case for the older people grow and the more fragile their bones become the sooner do these sutures become obliterated, and here is a specimen of a person known to have been 121 years old in whom the sutures as you may see are almost totally lost, scarcely a trace of any of them remaining, We know also that when fractures do occur after full adult age they are just as apt to extend across these sutures as to any part of the bone, We may then regard them as placed there for two reasons, one of which has been stated to be because the whole of the bones Could not have been developed from one point; and the other is to aid in parturition, and this is a most important use, as these bones are often forced to overlap before the head can be delivered particularly in cases where forceps are used, To understand how nature Confines the development of each bone within its own limits and thereby determines the situation of these sutures, it is necessary to notice that the deposition takes place between two fibrous membranes, namely the pericranium without and the Dura Mater with-in, now at determinate places there exists between these membranes certain junctions or partitions for the purpose perhaps of preserving their relations and giving form to their contents, which junctions of course limit the bony irradiations wherever the contact takes place, the irregularity with which these meet from the two sides perhaps giving rise to the inter-digitation or dovetailing in the serrated sutures; in the squamous of course the processes between the two membranes must be oblique, thereby giving rise to the overlapping, When any one of these bones is very irregular as the os-frontis for instance we find it developed from two centres, and uniting by a suture in the middle, which suture is however com-monly obliterated before any of the others, When Causes, as hydrocephalus, occur to expand the bones of the cranium, there sometimes are formed new centres of ossification between the bones by which the spaces are filled up, and this condition of spaces left

left in the healthy condition is probably the true cause of the development of the ossa wormeanea. Here we have a specimen whose history, although not known, has been probably that of hydrocephalus from the extensive openings which you see at the angles of the bones; now here you may observe what very commonly occurs in this disease rendering a cure almost impossible, namely, a very early union by bone of the different sutures of the base of the skull; when such cases are tapped as affording the only chance of cure; the bones of course cannot recede upon the brain and therefore retain a great deal of water inside whose presence is always accompanied by a continued secretion, many of you will no doubt remember a case of this which I operated upon before the class last year but from these causes, with only the effect of paliation. It is very interesting to see what apparent pains has been taken in the construction of the human head, and I think no architect ~~who~~ would take the trouble to study it would fail to derive instruction from it or would not consider himself well repaid by the perfect mechanism ~~example in construction~~ which would thus be set before him. We find as you may see, some parts of the cranium much thicker than others; but the centre ~~and~~ indeed the whole of the occipital bone, in this greatly exceeds the rest. And here again we see nature providing herself against the unavoidable accidents which she may have to encounter, in guarding the most important organs, and those most necessary to the performance of the vital functions, for in falls forwards whereby the head would be injured the hands are instinctively put out and thereby break the force of the fall; upon the side also this takes place to a great extent, and here also you have the parietal boss as a thick and strong protection; but to the back of the head there is no protection, except what little may be afforded by the elbows in breaking the descent, and hence you have the bone singularly thick and strong, being in addition crossed upon the inside by projections exactly similar in construction and office to the groinings in architecture which always serve to strengthen and support the arches under which they are

applied, We shall now commence the consideration of the bones in their proper order, and with regard to the relations which they bear to each other, In the first place then the head is divided for purposes of description into ~~head~~ cranium and face, the first of which has 8 bones, the second 14. Those for the cranium are the Os Frontis, 2 Parietal, 2 Temporal, occipital and the Sphenoid and ethmoid which are common to both cranium and face, The fourteen composing the face are the 2 Malar, Zygomatic or Cheek bones 2 superior maxillary, 2 nasal, 2 unguiform, 2 Spongy or inferior turbinated, 2 palate, a vomer and an inferior maxillary Bone, We shall first take up the os frontis or frontal bone, so called from its forming the front part of the head, and for the purpose of rendering its description more clear and defined, shall divide it into three portions, namely the frontal portion or that immediately above the eye brows, secondly the orbitar portion or that which forms the roof of the orbit, and thirdly the nasal portion or that which joins to the nasal portion of the upper maxillary bone and the proper nasal bone, - You will notice however, first the large size of the bone, and that its general configuration is that of a shell, being convex upon its outer surface and concave inside with depressions for lodging the convolutions of the anterior lobes of the brain, Also, that the frontal ~~portion~~ is separated from the orbitar portion by what is called the superciliary ridge which I here show you; that between these ridges of either side you have a protuberance, not quite so well developed here as in some other specimens which is called the nasal boss or prominence from its overhanging the nose, This upon being laid open exposes as you see in this adult specimen, a very considerable cavity or cavities for there are generally two with a partition of bone between them, These are called the frontal sinuses and communicate each by a separate passage with the ~~superior~~ middle meatus of the nose upon each side, being lined by the continuation of the same mucous membrane, and of course liable to the same diseases, one of which, distinguished by the appelation of a cold in the head, consists

in an inflammation of this membrane lining the sinus, which produces that feeling of tenseness across the forehead, and when severe gives rise to that severe headache which so often accompanies these affections, This frontal Sinus is not a mere expansion of the diploe of the bone, for it is not usually present in Children, which is perhaps fortunate as they are so subject ~~by their plethoric condition~~ to disorders of the mucous lining, and which would probably give rise to some obstruction before the perfect formation of the bone, whereby pressure might be exerted upon the brain, causing serious disorder or death, You will observe here upon the upper lateral part of the bone upon each side, a somewhat marked prominence, which is however only the primary point of ossification, and is never very distinct except in children who have been affected by Rickets or scrophula, We next upon turning to the inside of the bone, notice a ridge with a groove in its centre extending along the median line of the bone; this is for the accomodation of the longitudinal Sinus of the dura mater, and leads to a small foramen which we shall hereafter have to notice called the foramen cæcum, which transmits a vein from the ~~ethmoid~~ nasal cavities forming the commencement of this longitudinal sinus, We find that the orbitar portion of this bone is very thin and presents a concavity from above downwards, so thin is it, that it is readily broken, which has sometimes occured in fencing by the entrance of the foil above the eye, causing a wound in the brain and its membranes, and thereby death, This portion under ordinary circumstances, has however occasion for no great strength in as much as it is protected by its position as well as by the eye ball and the fat &c which surround it, It is terminated upon either side by what are called the external and internal processes of the orbitar portion of the frontal bone, the external uniting with the malar or cheek bone, and the internal with the ethmoid and nasal process of the superior maxillary bone: Just within the supercilliary ridge and near the external portion is seen a depression, which lodges the lacrymal gland for the secretion of the tears, and between the two

internal processes is the ethmoidal notch, projecting from the upper part of which you see a small spicula of bone which is the nasal spine for the articulation of the nasal bones, Upon the superciliary ridge some notches are observable, which sometimes exist as perfect foramina, there are two on each side, the ~~inner~~ outer of which transmits the frontal branch of the opthalmic B. fifth [illegible] from the [illegible] oph. nerve artery and frontal nerve and the ~~outer~~ inner, by the extention across it of a small round ligament forms the trochlea or pulley over which plays the trochlear muscle of the eye ball, just as the rope of the sailor plays through his block when he wishes to alter the direction of motion, These notches or foramen are very variable as to size, in some instances consisting entirely of bone, at others being entirely cartilaginous, There are also two other foramina which we have to notice upon the inner side of this orbiter plate, you see them here, they are called the anterior and posterior ethmoid foramina and transmit vessels and nerves from the orbit to the cells in the ethmoid bone, being of very little importance we shall not dwell farther upon them; Having now made up the anatomy of this bone we next take up the Parietal Bones, so called from forming the walls or parietes of the cranium, By removing them in this separated head we shall see that this is eminently the case, and that they have attachments to almost all the rest of the bones of the cranium, They are quadrilateral in form, having four sides and four angles, are convex upon the outside and concave upon the inside, where there exist a number of groves for the arteries of the dura mater,- The sides are called anterior posterior, superior and inferior, and the angles are the frontal, occipital, mastoid and sphenoid the latter of which, or the anterior inferior angle as it is sometimes called, is the only one of any importance. This importance it acquires from the fact of the existence in it of a ~~canal~~ groove and very often of a complete canal for the transmission of the middle artery of the dura mater, This groove as you may see runs up just where the bone is most thin and yielding, from which circumstance it is very apt to be ruptured either by blows

upon this part of the head, or by the transmission of the shock from some other portion; in case If you meet with such cases and have reason to suspect its rupture, if you wish to apply the trephine as the only hope of relief, this would be the spot upon which to operate, Some two years ago a very estimable man by the name of Albright, in this city, upon attempting to part two of his workmen who were fighting, received a blow from one of them upon the side of his head which felled him to the ground and somewhat stunned him, - from this effect however he recovered sufficiently to be able to walk to his house, a distance of several squares shortly after which however he became insensible and I was sent for to see him the next morning in consultation, I found him in a dying condition, and upon examination after death found the middle artery of the dura mater ruptured and a quantity of blood effused which had made its way down to the base of the brain and by pressure upon the pneumogastric nerve had suddenly interfered with respiration and consequently produced death, So you see it is important to recollect this angle in consequence of its always transmitting this artery, It is true that other arteries traverse other parts of the bone but they are not so large, nor so much exposed to injury, and therefore of less importance

When the two bones are placed together and we look upon the inside, we notice a groove immediately under the sagital suture, which is a continuation of that seen upon the frontal bone and transmits the longitudinal sinus in its course to the occipital bone, before reaching which however it receives by two foramina which are seen exceedingly large in the specimen in my hand, a communication from the veins of the pericranium upon the outside of the bone; these foramina sometimes amount to four in number, in which case they are not as large as in the one which I present to you, It will be seen by this fact, what might be expected, and what is daily experienced from the effect of cups or leeches applied to this part in affections of the

brain or its appendages, abstracting the blood directly from the vessels at fault and relieving at once not only the veins but through them the arteries and tissue of the brain itself. I do not wish to be understood as pointing these out as the only communication between the pericranium and the inside of the cranium, but on the contrary from what I have said upon the vascularity of bone, and particularly of these bones, you will understand that there is no part of the bone which is not penetrated by myriads of minute foramina by which direct communication is always maintained between all parts of the external and internal structures. These larger ones have received the names of Parietal foramina, and seem to be a kind of short cut for some of the larger vessels to empty themselves into the great sinus of the brain.

Lect. V.

I propose to commence the lecture of this morning with the consideration of the Temporal bone, so called because the blanching of the hair over that portion first reminds us of the flight of time. This bone is articulated with first, the parietal, then the occipital malar, superior maxillary sphenoid, ~~occipital~~ frontal and inferior maxillary. As I have already exhibited the manner in which some of these articulations are formed it is unnecessary that I should occupy time in a repetition the only peculiarity being in that with the parietal by the squamous suture. For the purpose of more convenient study this bone has been divided into three portions namely the Squamous which is the upper anterior portion exhibited above the direction of this ~~pebble~~, second, the mastoid portion, so called from the mastoid or nipple like projection from its lower part, – which forms the posterior inferior part of the bone, and third, the petrous portion, which receives its designation from its superior hardness. This division is not based upon the development of the bone, – but merely upon the facilities of description which it affords, – for as may be seen in this specimen that although the bone is really developed in three pieces yet these have no connection with the division, the

We see irregular depressions at times in various parts of the internal walls of the cranium – these are made by little vascular projections on the outer side of the dura mater, the vessels causing absorption of the bone & communicating with the diploic vessels –

mastoid or nipple like projection being developed as a process from the main bone whilst the auditory process is developed in the form of a ring from a separate centre of ossification as is distinctly seen in the preparation before us, This mastoid process, like the nasal protuberance of the frontal bone, is not found to any considerable extent in the young subject, but consists in the development of a number of cells which gradually enlarge as we approach the age of puberty, The auditory process which in the foetus is found in the condition of a ring attached to the main bone by cartilage, contains the membrana tympani placed within this ring somewhat like the crystal of a watch in its frame; and to it as you see the chain of small bones is attached, which are the only bones found completely ossified at birth — We shall first take up the Squamous portion of the bone for detailed description, and we see it convex upon the outside, rough and concave within, being there grooved for the lodgment of the convolutions of the middle lobes of the brain, When held up to the light you see this portion of the temporal bone is diaphanous or translucent, and is marked upon the outside with lines or ridges, occasioned by the contractions of the temporal muscle whilst the bone was yet in an imperfect state of ossification, This portion is in the normal condition of the parts entirely covered by the thick, strong, temporal muscle and its resisting fibrous aponeurosis, which with the superficial fascia and integuments form a very strong covering by which the necessity of great strength in the bone is avoided.

From the inferior part of this division you see springing a zygomatic or yoke like process which by proceeding in a horizontal direction encounters and articulates with a somewhat similar one from the malar bone, forming thus by a jugum or yoke called the zygoma under which passes the temporal muscle to its insertion upon the coronoid process of the lower jaw, Just at the root of this process you perceive a tubercle which is denominated the zygomatic tubercle by which displacement of the lower jaw from extreme depression, is prevented. In some persons this prominence is not so distinctly developed as in the case before us, and in such, dislocations are apt to occur from yawning or other

efforts in which the mouth is opened so widely as to
throw the condyle of the lower jaw out of its cavity
when it immediately slips in front of this tubercle
and produced a fixed condition of the bone in this
situation
~~condition~~, From this tubercle arises the external
lateral ligament of the articulation, which passes
to be inserted into the neck of the condyle; posterior
to this tubercle we find the glenoid cavity, so called
forming a shallow pit
from its possessing greater extent in one direction than
another, which condition constitutes glenoid cavities
wherever we find them; into this cavity as you see
we have the condyle of the lower jaw adapted,
and behind it, ~~and~~ constituting the bounding line
between the squamous and petrous portions we have
the glenoid fissure, upon the margin of which is
other lateral (?)
attached the posterior ligament of the articulation
In this fissure we have as you see a foramen which
is called by the same name, and which transmits
the Chorda Tympani or Vidian nerve in its passage
q between ~~its origin~~ ~~to~~ the lingual branch of the fifth pair ~~from~~ and
~~from the ganglion which xxxx xxx xx xx~~, to the cavity
of the tympanum; The origin course and distribution
is very distinctly seen upon this beautiful preparation
in which these nerves have been fully displayed,
In this fissure or foramen is also lodged this little
muscle called laxator tympani, which is connected
with the membrana tympani, and whose office it
is as its name imports to relax this membrane after
having been made tense by the antagonist muscle
which exists upon its other side, This is probably
the arrangement by which we are enabled to accom-
modate the organs to such a multitude of sounds,
and which enables us at the same time that we can
hear the faint chirping of a cricket, bear without
inconvenience the stunning report of the heaviest
cannonry, We next come to the consideration of
the mastoid portion, and this as before remarked
is principally developed as we approach the age
of puberty, by the increase in the size of the contained
cells. Now these cells all open into a common
passage which is continued into the cavity of the
tympanum, both passage and cells being lined by
a continuation of its mucous membrane, and of

course therefore liable to the same diseases; indeed we sometimes find this structure peculiarly subject to disease from obstruction in the passage by a thickening of the lining or other cause, in such cases giving rise to a very obstinate and troublesome fistula behind the ear. The uses of these cells have never been fully explained, but from their being very large in animals which are distinguished for sharpness of hearing they have been supposed to be in some way subordinate to this faculty; thus as may be seen by a preparation now in the museum, they are developed to ~~the~~ a great capacity ~~of gallons~~ in the head of the elephant an animal which is notorious for the acuteness of this sense; they are also found to be largely developed in the owl, also distinguished by the possession of this sense to an extraordinary degree. Just inside of this mastoid process I show you a deep depression which is called the digastric fossa from lodging the posterior belly of the digastric or double bellied depressor muscle of the lower jaw; and immediately upon the inside of this, we have another groove for the passage of the occipital artery from its origin in the external carotid to the base of the skull. The rough surface of the nipple like process is for the insertion of the Sterno Cleido Mastoid muscle which as its name imports extends between this point and the sternum and clavicle. Upon the inside of this portion we have a considerable excavation or channel occupied in the recent subject by the great lateral sinus of the brain in its progress towards a termination in the internal jugular vein at or in the jugular fossa, which fossa is composed, as you see, ~~by~~ placing the temporal in its relation with the occipital bone, is formed by, or consists in a passage of irregular shape between, these two bones, through which this sinus passes in escaping from the cranium, after which it takes the name of internal jugular vein. Here upon the surface of the bone you perceive another foramen such as I pointed out to you in the parietal bone, by which communication is had between the inside and outside of the cranium, and to which the same therapeutical observations are applicable, namely those in reference to the abstraction of blood from the surface, in affections of the organs or their append-

-inances contained within the cranium. This is called the mastoid foramen and is almost invariable as regards its existence at this point, in as much as it communicates directly with the sinus which lies imm-ediately beneath, the vein being accompanied in its course through the bone by a small artery.

We next come to the middle or petrous portion of the temporal bone, which from the number of its foramina and intricacies of its structure is confessedly a very difficult subject to comprehend, in so much indeed as to render its study almost painful. But when its importance as containing one of the most delicate useful and beautiful organs of our ~~Economy~~, is taken into consideration, ~~together~~ with the numerous disorders to which it is liable, the necessity of a correct and clear understanding of it will be at once appar-ent, and lead us to approach its examination with the firmer resolve for a mastery of the difficulties which it presents. Here is a preparation in which a great portion of the bone has been cut away for the purpose of showing a more clear view of the parts within. The arteries and nerves are here clearly seen, and the construction of the labyrinth with the semi circular ~~cartilaginous~~ canals, of the cochlea and vestibule, en-closed as they are in nature by thin bony walls, are exhibited with a fidelity which must very much facilitate their comprehension. This portion of the bone is of a pyramidal or triangular shape, the pyramid lying upon ~~its~~ one side and presenting its apex as you see forwards downwards and inwards. It therefore must ~~present~~ for examination, three surfaces three angles as well as an apex and a base, one surface looking anteriorly and somewhat upwards, another posteriorly and upwards and a third downwards, the base presenting outwards laterally. The superior angle of this pyramid looks upwards and forms the dividing line between the middle and posterior lobes of the ~~brain~~ cerebrum, giving origin to the tentorium upon which these latter are supported, and containing a groove for the lodgement of the superior petrous sinus. The posterior angle by its junction with the occipital forms the inferior petrosal sinus, the inferior angle is mostly & hardly seen. Upon the anterior surface, the first thing we notice is this long fissure at the end of which exists a foramen into which you see the probe

- A depression is seen near the apex for the casserian ganglion

has been passed, This fissure, from the anatomist who first described it is called the hiatus Fallopius and the foramen at its bottom, the foramen innominatum through which the before mentioned vidian nerve enters or rather comes from the cavity of the ~~ear~~ tympanum! We have upon this part also the commencement of the canal for the carotid artery, which as you see occurs immediately below the fissure just described, Near to this hiatus fallopii we have as you see another small foramen which transmits a branch of the nervus petrosus superficialis minor which appears to be essential to the perfection of the ear ~~& another depression which lodges a process of the dura mater called~~ Upon the posterior face the attention is first attracted to this large foramen situated near its center, which is the meatus auditorius internus through which passes with the auditory artery the seventh pair of nerves, consisting of the portia dura or facial nerve and the portia mollis or true auditory nerve; the latter of which is distributed in filaments to the cochlea and labarynth, many of them appearing to float loose in the fluid which these cavities contain, The portia dura or nerve of motion for the muscles of the face after winding around in the bone, in a canal called the canal of fallopius comes out by a foramen below and anterior to the ear to be distributed by a great number of filaments to parts which it supplies

7 canal Fallopius

Immediately behind this ~~meatus~~ is a foramen, which was believed by old Cotunius to be the aqueduct of the vestibule, he, conceiving the vestibule to be in a state of integrity for communicating sound only when partly filled by fluid immagined the necessity for an aqueduct or canal by which any superabundance of this liquid might be discharged; however exploded is his theory at the present day, the passage still bears the name of the aqueduct of the vestibule, although known to convey only some vessels and nerves; the manner of ~~this~~ removal of such redundancy of fluid being now explained by the action of absorbent vessels, it being never in a healthy condition found more than two thirds full, Near to this aqueduct of the vestibule you see the probe introduced into another foramen which however merely transmits some nutritious vessels & lodges a portion of dura mater. The lower part of this petrous portion as you see forms a part of the base of the skull, the apex projecting over the top of the pharynx, Now the relations which these parts

occupy are of no small practical importance, in as much as this apex frequently becomes the seat of caries and necrosis, and I have seen several cases in which the entire portion has been discharged through an opening at this point, The mucous membrane here is very liable to disease, and when infiltrated with pus may be felt by the finger introduced into the mouth, from which the fluctuating point may be opened. We find upon this surface several points to which it will be necessary to give attention First we have the styloid process, a spicula of projecting bone, of an inch or $\frac{3}{4}$ of an inch in length situated forward and a little inward from the mastoid process and giving origin to the 3 styloid muscles & 2 ligaments which will hereafter have to be noticed, Surrounding the base of this process, you have a deposit of bone somewhat resembling a sheath or sword scabbard and hence called the vaginal or sheath like process, which however is unimportant, Immediately above and in front of this process you have what is called the Parotid fossa, for a lodgment of a portion of the parotid gland; this as you may see, is from its situation subject to pressure from the opening of the mouth, and under circumstances of the sight of savory viands after long fasting, gives rise by such pressure to the ejection of a jet of saliva from the mouth of the excretory duct, We next come to notice a foramen and canal of greater dimensions than any which have yet concerned us, this is the external auditory meatus, leading from the external to the ~~internal~~ middle ear or tympanic cavity, When I say leading however, I do not mean that this passage is uninterrupted from the one to the other; on the contrary it is completely occluded in one part of its course by the membrana tympani so necessary to the perfect performance of the function of hearing,

Now in young subjects, you see, this auditory process as it is called, does not exist, because in them the structure is as yet cartilaginous and is therefore removed in the process of preparation, The bony ring which as you see in the adult specimen presents a rough edge in order for the firm attachment of the

of the external cartilaginous part of the ear, This canal of which we have spoken is generally about one inch in length, less than one half of which in the adult is cartilaginous, the remainder being and ~~bony~~ at the inner end of which as before noticed, are the membrane and small bones which are connected with it ~~constitute the apparatus~~. This membrana tympana, whose use appears to be to exclude the external air from contact with the delicate organs which it contains, is sometimes ruptured and the bones with pus & other fluids discharged, which ~~when occurring~~ normally follows ~~constitutes~~ a very troublesome affection, and one very difficult of remedy.

Upon the anterior part of the lower ~~portion~~ surface, we find a canal separated into two parts by a partition running its whole length, This is denominated the Eustachian tube one portion of which the upper accomodates a small muscle the antagonist to the one before mentioned as laxator, called the Tensor Tympani whose office, as its name imports is to make tense the membrane of the tympanum The other portion is free and constitutes ~~by~~ its analogy with the holes in a drum, the sound hole of the ~~drum~~ cavity of the tympanum ~~bane~~, exercising also an influence in maintaining an equable temperature and density of the air which is confined in the cavity of the ear, in correspondence with the external atmosphere This tube opens into the posterior nares just below the edge of the middle turbinated bone, and its obstruction is one of the most common causes of deafness with which we are acquainted and occurs very often as a sequella upon some of the eruptive disorders particularly Scarletina, In my capacity as surgeon to the deaf and dumb asylum of this city, of which I have for some years had the charge, I can assure you that this obstruction from the causes mentioned has been and is the origin of a great majority of the cases which have come under my notice, The mouth of this tube as occupying the situation is accessible to the introduction of a probe or catheter provided it be bent in a peculiar manner, and in consequence of this fact and the skillfull application to practice, a great many of the affections of this organ are daily relieved or cured, which otherwise would be hopeless.

We have before noticed the formation of the jugular fossa by the union with the occipital bone of the

The three layers of bone between is called the ~~processus~~ cochlearis forms a tympani

petrous portion of the temporal bone, but did not notice quite all the points in connection with it, Jutting into this fossa thus formed you see a small spicula or spine of bone, this divides the vein from the eighth pair of nerves which leave the cranium here to the inside of the vein, to get to their places of distribution ~~nearly~~ in front of this on the projection separating the fossa from the carotid foramen ~~spine~~ we see a small canal which Cotunnius ~~Cotunnius~~ supposed to be the aqueduct of the cochlea, but which is now known to be like the other aqueduct, only a place of transit for nutritious vessels to this organ; behind this we have an elongated groove which lodges the glossopharyngeal or pneumogastric branch the ~~important~~ nerve of the celebrated Jacobson an anatomist of Copenhagen lately dead, This nerve is particularly useful in the performance of the function of audition and is distributed to the cavity of the tympanum. Just within this a foramen for Arnold's nerve the tympanic branch of Pneumogastric And now one word more with regard to the portio dura of the seventh pair, Why does this nerve take the winding course through this bone to be distributed to the face? The object I believe to be that of distributing motion to the parts requiring it in its course as the small muscles &c. for we see that through the proper auditory nerve the function of hearing is performed, and by the vidian nerve, sensation (ordinary) is communicated, and by this course of the motor nerve filaments are thrown off and distributed with more minuteness than could have ~~obtained~~ happened under other circumstances, Here upon this beautiful specimen we can demonstrate the distribution of these nerves with great clearness ~~perspicuity~~ - we see here the ganglion of Cassel sending back three small nerves to the organ, and here the principal or large nerves making in all four, which are concerned in the function Namely the seventh, the nerve of Jacobson the vidian and the minor superficial petrous nerve, & the nerve of Arnold as well as branches of the sympathetic

**Lect VI.**

The next bone in order for our consideration, is that which forms the posterior part of the cranium, and which, in contradistinction to the Frontal which was formerly called the sincipital bone, received the designation of occipital bone, It is as you see rhomboidal in its general ~~figure~~ having four sides and four angles,

The two superior sides are articulated with the parietal filling up the notch or chasm formed by their junction, and the two ~~posterior~~ inferior or lower sides are received between the projections of the Temporal bones, and joined principally with Mastoid and Petrous portion of those bones. Its outer surface is Convex, - the inner Concave, - keeping up the general Spherical shape of the head. Through its inferior angle you perceive this large foramen or opening which has received the name of occipital or Basilar foramen and which conveys the Spinal marrow, the accessory nerve of Willis, with the vertebral artery and vein; In front of this we have the Cuneiform or Basilar process which by its anterior surface articulates with the body of the Sphenoid bone; and ~~this Bone is developed in four parts~~ under this Basilar process you have the Condyloid processes for articulation with the first vertebra or atlas. This bone is developed in four distinct portions, namely, the part posterior to the foramen magnum in one, - that anterior to the same foramen in another, - and each of the Condyloid processes in others, making up the four. These gradually become fused together, and by the 8th or 10th year are firmly united into one bone as you see in this specimen. Upon the outer surface you will ~~remark~~ observe a vertical spine or crest which is remarkably developed in the preparation before us the use of which is to give attachment to the ligamentum nuchae the rudiment of that structure which is so strongly developed in animals with pendant heads, and of which I spoke whilst upon the ligamentous structures. On each side of this vertical one, you have two transverse ridges, which from presenting a somewhat curved direction, have been called the superior and inferior semicircular ridges of the occipital bone. These are occasioned by the insertion of muscles, which also occupy the spaces between and below them. Into the superior ridge we have the posterior belly of the occipito-frontalis, Trapezius and upon its outer end the Sterno Cleido Mastoid muscles; - into the space between and upon the inferior ridge, we have the Splenius Capitis and Complexus both exceedingly strong and powerful muscles: and below this ridge, the small recti and obliqui muscles which however it is hardly necessary to remember as they are of little practical importance. Upon the inside of the bone we have two ridges Crossing in the Centre,

These like the groinings of an arch, are intended to support and strengthen the arched form of the cranium and taken together form what is spoken of as the occ-ipital Cross, The groove seen at the side of the superior or vertical limb of this Cross, is for the lodgment of the longitudinal Sinus, and is generally found upon the ridge ~~rather~~ than at the side as in this instance, Those upon the ~~transverse~~ limbs are for the lateral sinuses, into which the great longitudinal one divides; upon the inferior limb you also see a small groove for the inferior occipital sinus; and the meeting of these four limbs and sinuses at what is called the internal protuberance of the bone, form what was spoken of by the older anatomists as the Torcular Herophili, from a resemblance to the wine press of the ancients, The great longitudinal sinus at this point divides, as before mentioned, into the two lateral, which after receiving the inferior occip-ital, proceed transversely to the mastoid portion of the temporal bone where we have seen them turning downwards towards the jugular fossa, there to become the internal jugular vein, The inferior limb of the Cross is called the Crest, and gives origin to the falx cerebelli, or septum between the lobes of the Cerebellum; the transverse limbs also give origin to a firm membranous structure called the Tentorium, upon which are supported the posterior lobes of the Cerebrum, This crossing of the ridges gives rise to four depressions, the two superior of which lodge the posterior lobes of the cerebrum, and the two inferior the Cerebellum, I shall next direct your attention to the margin of this foramen Magnum, and here you see attached as it were to its anterior semicircumference the two Condyles for articulation with the atlas, whose situation and direction merit particular notice; they are situated as you see upon the edge of the foramen and their oval faces converge forwards, inclining outwards and ~~downwards~~ upwards, so that the direction of their artic-ular facets is looking obliquely forwards, outwards, and down-ward, In consequence of this peculiar arrangement they set into the atlas, as it were, and of course are

capable of motion only in one direction, which is that of oscillation or nodding, permitting of no motion whatever in the other direction, Coming through the anterior part of the base of these you see a foramen which is called the Anterior Condyloid, and transmits the nerve 9th on its way towards the tongue namely the Hypoglossal or Ninth pair; piercing the posterior part of the base we have another foramen of smaller size called the posterior Condyloid foramen, which transmits some small vessels We next observe the cuneiform process, which you see is about an inch in length and roughened upon its lower side for the firm attachment of the mucous membrane of the pharynx, which it overhangs, and into which the pieces of dead bone are eliminated in caries or necrosis of this portion, which sometimes occurs, Upon the body of this process you see a slight elevation or tubercle, for the insertion of some of the constrictor muscles of the pharynx, and anteriorly its facet for articulation with the Sphenoid bone, The upper surface is grooved for the lodgment of one of the most delicate parts of the nervous Centre, namely the medulla oblongata, which occupies its whole superior face, As individuals advance in life, this process is very often found fused with the sphenoid, from which Meckel and some other anatomists have described them as one bone under the name of occipito sphenoid, When the bone is placed in its relation with the ~~Sphenoid~~ Temporal bone you see the manner in which it aids in the formation of the jugular fossa, and see also the jugular eminence as it is called which together with the spine which you saw upon the temporal bone almost converts a part of the fossa into a foramen for the jugular vein, These bones in the dry state do not form a proper joining here, but when the fibrous matter which fills these spaces, and transmits some delicate filaments of nerves is present the whole arrangement becomes more regular and loses its character of foramen lacerum posterius as it is called in the dry condition, We next come to speak of the

## Sphenoid

bone, so called from its forming a kind of wedge, being articulated to all the other bones of the cranium

These serve to weaken the force of blows – describe the bones – their position – their separate injuries

to which it acts as a key or abutment for their support and must receive by transmission much of the shocks produced by blows upon the head, from the situation which it occupies; we are therefore not to be surprised that bleeding from the spenoid cells sometimes follows such occurrences. This bone is also articulated with five bones of the face, and therefore is one of those said to be common to the cranium and face. In general configuration it is said to resemble a bat with extended wings the great wings of the sphenoid the body representing the body of the animal and the vertical or pterygoid processes, the legs whilst the two small processes in front form the ears. For purposes of more easy description it has been divided into four parts; the great wings, the lesser wings or apophyses of Ingrassias, the body and the pterygoid processes, the study of which we shall take up seriatim.

The body of the bone presents one surface towards the cavity of the cranium, forming a part of the floor of this cavity, and another towards the face which forms the part of the roof of the pharynx; from the upper portion of the body spring out the lesser wings, and these two processes which you see here one on each side which are called the anterior Clinoid processes; between these

Clinoid proc

you have this little well rising which from its shape is called the processus olivaris, and upon which as a kind of table we have the Chiasm or crossing of the

Chiasm

optic nerves, in their passage to escape from the cranium through the two holes or foramina which you see under the lesser wings, – into the orbit. From the back part of the body you have arising two other small processes, corresponding

post. clinoid

to the two in front; these are called the posterior Clinoid processes, the former having received this name in consequence to a fancied resemblance to the posts of a bed. Between these Clinoid processes, we have a deep depression for lodging the Pituitary gland, a body whose

Pituitary gl.

use has not as yet been made out, but supposed by many to be ~~continuation~~ connected with of the sympathetic nervous system; this depression is called the Sella Turcica, from its resemblance to a turkish or mexican

Sella Tur-

saddle, which as you know is very high both behind and before; at the side of the body, we see running up that groove from the end of the petrous portion of the

Groove for Carotid

Temporal bone; this is for the accomodation of the Carotid artery, which after making a turn in the petrous portion of the temporal bone, gains the side of the sella Turcica, after traversing which it makes a second rectangular turn and ascends vertically to the brain, just within the anterior Clinoid process. Now what is the object of this turning, in opposition to what occurs in the course of any artery in other parts of the body? Merely to lessen the impetus of the blood going to the brain, without lessening the quantity, whereby this organ is fully supplied without the shock which would necessarily occur if no arrangement of this kind had been provided. In some of the inferior animals, in whose pendant heads gravity assists this impetus of the blood, even this arrangement is not sufficient, and we thus have the Carotid arteries dividing in the most singular man-ner, into a great number of branches, which again unite into one trunk which passes on to the brain. This arrangement is called the rete mirabile, and may be likened to a river, which after dividing into many branches, is again collected into one stream the sudden afflux of water upon whose banks has been prevented by this arrangement. Upon the side of this sella Turcica and pierced by this Carotid canal we have another of those large sinuses of the brain, which is very important in some diseases of the eye from the fact that its engorgement, will at all times exercise a pressure upon some of the nerves of this organ which lie in immediate connection with it. This is called the Cavernous sinus. In turning to the inferior surface of the bone the first thing which strikes us is the existence of two large cavities or cells, called sometimes sinuses, which like those in the frontal bone are the product of adult age, and do not exist to any extent in the Child as you may see by this specimen. These are separated from each other by a thin partition and each have an opening into the posterior nares, or top of the Pharynx; and being lined by a continuation of the mucous membrane of those passages, are of course liable to their diseases, and frequently become the seat of dis-charges in common Colds. From their excessive vascul

Rete Mirabile

Cav. Sinus Disease of Eye

cells

-auity, these cells are liable also to a species of fungous growth an increase of which, from the exceeding delicacy of the upper lamina of the bone, may very easily interfere with the the brain and produce incurable lesion. Upon this large model I am enabled better to show you the extent of these cells and their relations with the contiguous parts; - here you see the opening into the posterior part of the nostril or top of the pharynx; and here the extent of the sinuses with the delicate plate of bone which surrounds them. I have seen some severe and irremediable cases of neuralgia, from the pressure of tumours in these cells upon the nerves which lay around them, and one case of anaesthesia of the eyeball as it is called which I have no doubt originated in the interference by a tumour or fungus growth in these cells, with the ganglion of Gasser. The result in this case was precisely that of cutting through this ganglion in the inferior animal; the patient for a long time suffering pain and intolerable itching of the eye ball, the absence of sensibility in which allowed her to scratch it roughly, until ulceration and sloughing of the cornea took place, with complete desorganization of the whole organ. There has also been a case here at the clinic and which you will probably again have an opportunity of seeing, in which a serious affection of the eye ball is I have no doubt dependent upon some lesion of these nerves. We next come to the consideration of the lesser wings, which as you see extend along the back part of the orbitar plate of the Frontal bone, presenting within a somewhat serrated margin or rather spine for articulation with the Ethmoid ~~or frontal~~ bone; the projections of which are called the Ethmoid spines; by which articulation the Ethmoid bone forms a part of the walls of the Sphenoid cells. between these two bones and developed by the Ethmoid we find this little bone the sphenoidal spongy bone and which is called the pyramid of Wistar, which by an increase in the extent of the cells towards adult age, becomes detached from its place of development and united to the sphenoid bone. Between the greater and lesser wings you have this large irregular opening, which is called foramen lacerum superior of the orbit, and transmits from the cavity of the cranium. the third, fourth,

Sixth and first or opthalmic branch of the fifth pairs
+transmits into the cavity of the cranium the ophthalmic vein
of Nerves; Called superior to designate it from the one
which you see here opening into the temporal fossa which
is Called the inferior foramen lacerum of the orbit; this I
show to you although somewhat out of place in order that
you may the more easily remember the two in conjunction.
The greater Wings spring out as you see from the sides
of the body, outwards and upwards, and present for
our consideration, three surfaces, namely a cerebral
a temporal and an orbital, The orbital portion forms
the outer posterior part of the orbit, or all that portion
upon which my finger rests, articulating in the orbit with
the malar maxillary and frontal bones, being at its
upper and outer part joined with the lesser wing where it forms
the projection entering into the fissure of Sylvius in the
brain and thereby supporting the anterior lobes at the same
time that it overhangs and protects the middle ones.-
This angle of junction with the lesser wings or apophyses of
ingrassius, forms the boundary between the orbital and cra-
-nial surfaces, the latter of which you see is generally con-
-cave, and deeply grooved for the passage of the middle or
great meningeal artery, which as you have seen when stu-
-dying the temporal & parietal bones, ascends the side of the cranium
at the junction of the posterior angle of this greater wing
with that bone; this surface has also some depressions
for the lodgment of the Convolutions of the middle lobes of
the Cerebrum, The Outer or Temporal surface of this
bone enters largely into the formation of the temporal
fossa, filling up the fissure between the temporal bone
and those of the face, Upon this outer surface you see
here a rough transverse ridge running across the wing divi-
-ding the surface into two portions; this is called the pter-
-ygoid ridge and gives origin to one of the heads of to the external pterygoid
or grinding muscle of the lower jaw.- the upper and
outer portion is called zygomatic, and the lower pterygo maxillary
portions, or tarsae which however is of no practical importance,
Upon the front part of the body of the Sphenoid we
have this small beak projecting out, this is called
the rostrum or azygos process, and is for articulation
with the vomer or plough share bone which forms the
posterior separation between the nostrils; this peculiar
kind of articulation is called that by schindylesis,

From the junction of the greater Wings with the body of this bone arise these two vertical processes called pterygoid; they are formed as you perceive, by an outer broad and thin plate, and by an inner narrower and longer one, between which lays this which is the pterygoid fossa; in the lower part of this fossa you perceive a long notch, which is filled up by a process from the palate bone, which thereby completes the fossa which is for the lodgment of the internal pterygoid muscle; the external coming as before mentioned from the pterygoid ridge & the outer side of the External process upon the outside. Near the base of this bone we have the foramen rotundum or round opening for the transmission of the second branch of the fifth pair in its course from the Ganglion of Gasser to its place of distribution, namely the superior maxillary bone to the outside and posteriorly to which we find the foramen ovale, conveying the third branch of the fifth pair to the lower maxillary bone together with a small artery and vein, and the nervus petrosus superficialis minor which as we have before seen enters the cavity of the ear. Near this last and upon its outer side we have the foramen ~~Spinale~~ Spinosum, in the Spinous process of the great Wing of the bone transmitting the great middle artery of the dura mater, It is well to notice in what manner this spinal process is locked between and fills up the fissure between the Squamous and petrous portions of the temporal bone, leaving however, between its posterior edge and the apex of the petrous portion of the temporal an irregular opening called foramen lacerum Anterius Basis Cranii. Another foramen may be seen near the base of the pterygoid process, called also pterygoid or vidian which transmits the vidian nerve from the Ganglion of ~~[illegible]~~ Meckel. At the end of the internal or longer plate of the pterygoid process, you see this little hook or hamular as it is called, which with the cartilaginous portion that surrounds it serves as a trochlea around which plays the tendon of a small muscle which arises from the point of the Petrous bone! the outer part of the base of this process, to be inserted into the velum pendulum palati to circumflex or make tense that organ, This is called the Circumflexa or tensor palati which by this trochlea is made to act at right angles with its origin,

I have been thus particular in describing this bone not because of its great practical importance; neither because I shall expect you to remember all its details, for I don't think this necessary to make you good prac-tical physicians, but because the descriptions in the books are meagre, and not sufficient to a good understanding of it which, every student should have at the outset,

Lect. VII.

I propose to commence the lecture of to day with the consideration of the

## Ethmoid Bone

Which has received its name in consequence of its ext-reme delicacy of structure, and the multitudinous perforations which exist in some parts of it rendering it seive like; - the term coming from Ethmos a seive, This bone closes, as you see, the opening between the orbitar portions of the Frontal bone, and is destined for the lodgment of the nerves of smell, In this prep-aration where you see this bone has been colored blue whilst the sphenoid is yellow, - the frontal remaining white you are enabled to distinguish its different parts, - and thus you see it has a cranial portion, which assists in the formation of the floor of the cranium; a facial or front portion, and lateral portions which aid in forming the lateral walls of the orbit, For purposes of description anatomists have divided this bone into three parts, namely, the cribriform plate, the two later-al masses and a middle partition called the nasal lamella which forms a part of the separation between the nostrils, The lateral masses being the place of distribution of the olfactory nerves are the sole seat of the sense of smell, - and the fact that the sense cannot be quite as well performed after the removal of the anterior soft parts, is due to the loss of that fun-nel shaped opening by which the odours are collected and concentrated upon them, Here you see we have an Ethmoid bone broken in order to show the lateral masses more distinctly, you there see distinctly also the cribriform plate and the nasal lamella, Upon this cribriform plate exists upon either side, a depress-ion for the bulbes of the olfactory nerves where they divide into three rows and pierce the bone to be dis-

tributed exclusively upon the bones before indicated. Between these two depressions you have rising up from the cribriform plate this ridge or crest, which is called Crista Galli from its supposed resemblance to the comb of a Cock. This is for the sole purpose of giving a firm attachment to the Falx major a strong membranous partition interposed between the lobes of the cerebrum, in order for their support when the head is laid upon its side, a condition which without some such arrangement must cause pressure by one lobe upon the other, and consequent derangement of functions. From the under surface of the cribriform plate and immediately opposite to the Crista Galli we have the origin of the nasal lamella, which although exceedingly thin and diaphanous, has been proved to consist of two plates with an intervention of the ordinary diploic structure of bone between. This is covered by the mucous membrane of the nostril, which being periosteal or fibrous upon its inside, performs this office of periosteum to the bone, and it is in consequence of this that the Schniderian membrane as it is called, is so subject to involve the bones in its diseases, particularly in the inflammation of Syphilis wherein the bones very frequently become carious and necrosed, giving rise to those deformities which we see in the faces of old syphilitic subjects. Upon the outer surface of each lateral mass we have this thin parchment like ~~surface~~ plane presenting into the orbit, which from its smoothness is called Os Planum; and which is covered by the common periosteum of the orbit extending over it. The inner surfaces of these masses, is roughened presenting under the microscope great numbers of little hooks, precisely like tent hooks, upon which the lining membrane is securely fastened; the inferior portion of each mass has a convoluted appearance, as though it had been rolled into a scroll, and has therefore received the name of middle turbinated bone; from the inferior margin of this depends a portion or fold of the mucous membrane, which seems to be thus duplicated into folds for the purpose of increasing the extent for the ramification of the olfactory nerve and thereby increase its capacity for receiving odorous

impressions; The space beneath this convoluted termination and between it and the proper turbinated bone we have the middle meatus or passage of the nose, and above this, running only half the length of the bone we have another which is called the superior meatus and its boundary above is called the superior turbinated bone, Thus we have three turbinated bones, two of which are parts of the Ethmoid, and between and below them three meati or passages; These are well exhibited upon this large model; upon you see the situation and succession of the passages, and the turbinated bones which separate them from each other; this superior convolution or turbinated bone is sometimes spoken of as the Cornet of Morgagni, The whole of the bone is cellular and all the cells lined by the schniderian membrane; these are divided into two sets, separated by a nearly vertical septum or partition, the posterior set communicating by an opening with the superior meatus, the anterior with the middle meatus,
The frontal sinus which we have before noticed as being lined by a continuation of the schniderian membrane and communicating with the nostrils, effects this through these anterior ethmoidal cells by this funnel like prolongation called the infundibulum, which by means of these cells is continued into the middle meatus,
Now we may readily suppose that in inflammations which take place in this membrane by which it is thickened so as to obstruct the passage, an accumulation of the discharges may take place, giving rise to great inconvenience, and in some cases producing a diseased condition of the bone and a fistula upon the forehead which is exceedingly difficult to heal, from the fact that after the natural passage becomes opened, every breath forces the air through the opening, It has been found possible to introduce a probe when properly curved, from the nostril into the frontal sinus, and this has been of great advantage in these cases of obstruction, This bone seems to have its cellular structure for two important purposes, first to give great space for the ramification of the olfactory nerve and secondly to diminish weight where bulk was necessary without any extraordinary strength, This finishes

our consideration of the bones of the cranium, and we now come to speak of those of the face which are fourteen in number whilst those of the cranium were only eight. These of the face are divided into those belonging to the upper jaw and middle part of the face, and the single one which constitutes the lower part of the face, namely the lower jaw. Those of the upper part consist of thirteen bones, six pairs and a single one, namely two maxillary, two malar or cheek bones, two palate, two inferior turbinated, so called from their scrolled or convoluted form, two ossa unguis from their resemblance in shape to the thumb-nail, also called lachrymal bones from their partly lodging the lachrymal sack, two nasal, from their forming the bridge of the nose, and the odd one which is the vomer or ploughshare bone. The first of these which will occupy our attention is the

## Superior maxillary

Bones, these are two in number and seated upon either side of the face, and constituting the greater part of its middle portion. At first sight it would strike us as being a remarkably large and heavy bone, but a very slight examination soon enables us to correct this idea, for we find upon taking it up that it is quite light, and upon looking at its nasal surface we discover that it is hollow, or that its body is occupied by an extensive cave called antrum maxillare. By an examination of most of the bones of the face, it appears to have been the design of nature to make them as light as was consistent with a sufficient strength and at the same time to leave no space which might not be subservient to some useful purpose. Thus we see in the whole pile of bones precisely that condition best calculated to ful~~file~~fil these indications at the same time that it gave to the face sufficient extent for that expansion of the nasal duct expression which is so characteristic of man.

This bone is divided for purposes of better description into a body and processes. The body contains as you see this large cavity, called as before mentioned the antrum maxillare or antrum Highmorianum from the anatomist who first described it; this cavity or antrum is said by some to be useful in the production or perfection of the voice, which

however has not yet been established, The roof of this antrum forms the orbitar plate of the superior maxillary bone, being a part of the floor of the orbit, It is exceedingly delicate and thin, as may be seen in this specimen in which the cavity has been laid open, notwithstanding which it is composed of two compact plates with an intermediate diploe in which is lodged the infra orbitary canal, for the ~~trans~~mission of the infra orbitar nerve & artery which is distributed from this orifice or foramen, over the face, This is a very important nerve from the fact of its being the seat of a great majority of the facial neuralgias with which we meet and which present such annoying obstructions to successful treatment, From the extreme delicacy of this orbitar plate, it will be seen at once how easily morbid growths within the cavity may effect the eye and from such causes I have seen the eyeball with all its membranes and muscles protruded almost entirely out of the socket, the superior wall of the cavity being that which most easily gives way before such tumors, The canal spoken of as the infra orbitar opens by the infra orbitar foramen upon the lower and inner margin of the orbit into ~~that~~ depression called the Canine fossa, from its being well marked in the dog, just behind a column and giving origin ~~to~~ the long teeth called by the same name, At the posterior portion of the bone we have its tuberosity a prominence which is exceedingly well marked in children, but becomes gradually obliterated as the individual advances towards puberty, What is the object of this tuberosity? It is for the lodgment of the germs of the large permanent teeth, and therefore loses its character of a tuberosity as these become developed and develop with them the alveolar processes; for we know that until developed by the presence of the teeth no such processes exist, Then in as much as we know that the teeth after having attained their length never grow farther and that the alveolar processes never exist without the teeth; and know also the front and side permanent teeth are developed long before the large molars; we must see as a consequence that if the maxillary bone grows at all in a horizontal direction it must be from the posterior ends, by the production of the molar teeth succes-

-sively, and by this stretching out as it were, in proportion to the increased size of the germs of the teeth, the tuberosity becomes gradually lost in the increased extent of the alveoli, and this does not take place to its entire extent until about the age of ~~puberty~~ twenty or more or when the last molar or wisdom tooth as it is called, shows itself through the gum, so that the progressive development is apparently always at the expense of this tuberosity. So much for the body of the bone, we now come to consider its various processes, and first of these, the nasal process or that part of the bone which extends up to be articulated with the firm inferior edge of the nasal portion of the os frontis, This process is as you see quite firm and strong and has a firm articulation with the last named bone; this gives it the character of a column of support against the action of the lower jaw, which being the only movable part in the whole structure, acts upon the upper in biting or snapping, as a hammer upon an anvil, and this column resembles the support which the anvil gets whereby it is enabled to resist the force which is exerted upon it. The nasal ~~process of~~ surface of this process is concave somewhat and forms a part of the walls ~~of~~ of the nostril, being articulated upon the outer side with the nasal bone, the two of which fill up the cavity or opening between the two maxillary bones at this upper part, These processes together with the nasal bones differ somewhat in different individuals, being wider or narrower as the eyes are farther apart or closer together, The lower edge of this process is sharp and notched or serrated for the attachment of the cartilaginous structure of the nose, Upon the dry bones when placed in situ you may see the form of the opening constituting the cavity of the nostril, which has been compared in shape to the heart upon a playing card, On the orbital surface of this process may be seen a groove or channel which is converted lower down into a canal running nearly vertically into the side of the nostril, This is for the conveyance of the lachrymal secretion from the orbit into the nose, and the upper part lodging the lachrymal sack is called the lachrymal fossa, whilst the canal formed by

this and a portion of another bone (2) as we shall see hereafter, is called the ductus ad nasum. The situation and relations of these parts merits and should receive particular attention, as they are concerned in a very common operation, namely that for lachrymal fistula, which consists as you all probably know in making an opening through the canal and inserting into it a style or pin. Now I have seen this style from faulty management, driven into the cavity of the antrum, thus giving rise to inflammation and its consequences to the great inconvenience of the patient; and if you push your style straight down instead of knowing and following the direction of the canal, you will be very likely to force it into the antrum for the bones here are so thin as to be readily perforated without the use of much force. Under circumstances of solid bony occlusion of the canal, it has been recommended to pass the style into the antrum, and this has been sometimes usefully done, but in general the inflammation produced by it is of such a degree as to occasion a great deal of inconvenience. It ought to be abandoned it would be better to drill a hole to pass in a tube – We next come to the consideration of the malar process, which exists upon the side of the bone and forms a strong junction or articulation with the malar bone. These with the continuation from the alveolar processes of the molar teeth, form a very strong column or pillar of support for the action of the lower jaw, transmitting as in the case of the nasal process, a great part of the force to the firm and solid frontal bone, this column however being the stronger of the two. The peculiar use and intention of this column is exhibited by the child in attempting to crack a hard nut between his teeth, he places it without however knowing the reason, precisely between the molar tooth in the base of this column and the opposite one in the lower jaw, knowing from experience or instinct as it were, that more force can be exerted safely here than at any other point of the whole circumference. The lower surface of the bone in the adult specimen is marked by the projection of the alveolar processes, eight of which are found in each bone. These do not exist in children without teeth for the reasons before mentioned namely that

they are only intended as sockets for them and are therefore only found with them, In some heads the roots of some of the teeth are found projecting into the cavity of the antrum; those most usually so found being the first and second large molars, Now as the whole cavity is lined by this muco fibrous membrane which is very liable to disease and covers closely over the projecting roots, it is easy for us to suppose that when these roots become diseased or irritated, they must necessarily affect this membrane, which when inflamed instead of pouring out a thin serous fluid secretes one of a thick and viscid character which accumulating in the cavity give rise to neuralgic pains of a paroxysmal character which gives the patient a great deal of suffering, This not only occurs when the tooth actually projects into the antrum, but sometimes when it merely approximates it closely, when the irritation affects it from contiguity.

The remedy for this condition is of course to draw the offending tooth and discharge the matter by the opening left, or where the particular tooth at fault is important to be kept, some other one may be drawn, or the antrum may be punctured by a trochar upon its outer surface, - If after having removed the tooth the matter does not flow you can then introduce a small trochar, or making a puncture through the socket with your penknife and afterward turning it around so as to drill a hole there, evacuate the contents without difficulty. We next come to speak of the palatine process of the upper maxillary bone, so called because it forms a great part of the roof of the mouth and the floor of the nostril, This process as you see extends from the roots of the alveolar processes across to be joined with its fellow of the opposite side by a serrated articulation which is exceedingly hard to place together after having been once separated; the posterior margin of this process looks towards the top of the pharynx, and is articulated with the horizontal process of the palate bone, The raphe or junction between this process of either bone is raised within the nostril for articulation with

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intermaxillary bone, or os incisivum: how formed —

the vomer and is called the nasal ~~spine~~, crest: its projection in front is called nasal spine. The lower surface of of these processes are roughened for the firm attachment of the mucous membrane by which they are enveloped. Upon the upper surface of each process near its front part exists a foramen which converges to meet its fellow of the opposite side, opening into the mouth by a single orifice called the foramen incisivum from being just behind the incisive teeth which in many animals have a separate bone for their insertion called the incisive or intermaxillary or premaxillary bone, This foramen transmits branches from the palatine ganglion of Cloquet which is a part of the sympathetic system and also branches from the fifth pair, These processes with the horizontal processes of the palate bone, form the whole of the bony roof of the mouth,

premaxillary from lying in front

Lect. VIII.

The Bone with which we must next occupy ourselves, as being a kind of compliment or addition to the upper maxillary is the proper

## Palate Bone

This is situated at the back part of the superior maxillary with which it is articulated, forming a complete partition between this and the pterygoid processes of the sphenoid bone with which it is also articulated It may be better described by dividing it into several portions or processes, first this which is its horizontal process is articulated with the palate process of the maxillary bone; next its nasal or vertical process by which it forms a part of the wall of the nostril and which at its top bifurcates into the orbitar process and the ~~pterygoid apophyses~~ sphenoid process called sometimes pterygoid apophysis, and lastly its pterygoid process or that part which articulates with the pterygoid plates of the sphenoid bone, Now in reality there is no difference in meaning between the words process and apophyses, the one being merely a translation of the other, and yet anatomists have applied the two to distinguish two different parts of the same bone, which for fear of misconception, it is well to remember, You perceive that the nasal lamella of this bone enters somewhat largely into the formation of the lateral wall of the nostril thereby encroaching upon the large orifice by which the antrum would at first sight appear to lead into the nostril,

This opening is still more diminished as we shall hereafter see, by other structures. Between this nasal lamella and the maxillary bone indicated by these grooves upon the bones, is situated a canal which transmits the posterior palatine artery and nerve, which canal is called the ptery-go Palatine ~~maxillary~~. At the top of this nasal process you see the notch dividing it into the orbitar process, and Sphenoidal ~~pterygoid~~ apophyses, now this notch is converted, by placing this bone in its proper relation with the sphenoid into a perfect foramen, which is called the spheno palatine foramen, and conveys the the last branch or extremity of the maxillary artery ~~and nerve~~ directly into the nostril, the nerve going to the spheno palatine ganglion and the artery to be distributed upon the lining membrane of the nose. Here I show you a specimen from which the anterior part of the maxillary bone has been cut away so as to exhibit more clearly this foramen. The pterygoid process which we next take up, we find going to fill up the space or notch between the plates of the pterygoid process of the Sphenoid Bone, and the articulation there formed is the firmest which the palate bone has at any point. This process fills out and completes as before mentioned, the pterygoid fossa, and forms a part of the surface of origin of the internal pterygoid or grinding muscle of the lower jaw. The horizontal portion of this bone is extended across to unite by a firm articulation with its opposite fellow, the two when in apposition forming a process upon the middle line jutting backwards to which is attached the uvula and from the whole posterior edge is extended the velum pendulum palati. There now remains for us only to notice a ridge upon the internal surface of the nasal lamella which as you see is continuous with one of the same character upon the nasal surface of the maxillary bone, and is intended for the lodgement of the next bone which we shall take up, which too, like the last seems to be but a complement to the maxillary bone. This is called the

## Inferior Turbinated

Bone, which unlike the superior and middle turbinated bones, which as we have seen are but portions of the ethmoid, is a separate and distinct bone, and

has received the designation of turbinated from its rolled or scroll like appearance. It is in its consist-ention exceedingly light and porous, and has its surface covered with those little hooks, before mentioned, upon which to hang the mucous membrane which covers it. Upon each extremity of this bone, is noticeable a depression or twist by which it is lodged upon the ledge or ridge upon the maxillary and palate bones, the mode of articulation being as I show you in this specimen where you see the bone occupying its exact position. Upon
call lachrymal process
the anterior part you see it sends up this small plate to aid in forming the inner wall of the nasal duct, being suspended upon the maxillary bone by a small
called maxillary process
hook or hamulus, which you may see as I draw the bone out still retains its hold. You may also see here a small vertical plate hanging over the opening of the
called Ethmoidal process
antrum, diminishing it to a still greater extent, it being diminished farther by the folds of mucous membrane which hang free around the opening, so that from being of the enormous size ~~to~~ which you see it originally in this maxillary bone, it is diminished in the ordinary condition of the parts to about the size of a crow's quill which however always remains open for the discharge
There are usually two of these foramina opening into the back part of antrum
of the fluids secreted from its lining membrane; these are emptied into the nostril by the positions which we assume when lying, that of the right side being emptied out whilst we lie upon the left and con-versely. These orifices open into the ~~inside~~ middle meatus of the nose which of course would be inferred from its
above
occurring ~~below~~ the inferior turbinated bone which seperates the middle from the inferior meatus.

This Bone is of scarcely any practical importance except from being concerned in the formation of the ductus ad nasum which is subject to obstruction and stricture, and very frequently requires an operation for its relief; it is therefore well to notice particularly the relations of these bones, and the fact that this inferior ~~and~~ spongy bone with the os unguis, both exceedingly light and thin form the internal wall of the duct, by this triangu-lar space the upper part of which lodges the sack. Through this duct by its orifice in the inferior meatus of the nose it is always possible to introduce a probe, provided it be properly curved and applied with the proper tact

This probe which I show you, I had moulded upon the bones, and have used it a great number of times without inconvenience or pain to the patient. It should first be placed with the handle downwards and the point at the orifice in the nostril, then by gradually bringing the handle around, allowing the instrument to find its own way as it were, you may readily pass it entirely through the duct. In diseases of the antrum it has been recommended to pass a probe into the middle meatus through the opening into this cavity, which may be done, although it is somewhat difficult, and has not appeared in my hands to be of sufficient use to warrant its adoption; the other modes of penetrating through the socket of a tooth or even drawing a tooth, seems to me much preferable, the offending matter flowing out more freely and more perfectly. There exists in this region another small bone which will require a few words, and only a few in as much as it is only important from its exceeding delicacy and the position which it occupies with regard to the before mentioned operation for lachrymal fistula; this is the

## Unguiform

Bone, so called from its resemblance in shape to the thumb nail. The internal or nasal surface of this bone is roughened for articulation with the ethmoid bone, and forms the wall to the anterior ethmoidal cells. It is articulated with the frontal, superior maxillary, ethmoid, and inferior turbinated bone, and is divided into two portions, one called the orbitar forms a part of the lateral wall of the orbit and extends to the groove for the lachrymal sack, where the other or lachrymal portion commences, and it is through this portion that the opening for the duct to the nose is made. This is the part most important to the surgeon, in as much as without knowing its delicacy and the direction of the canal, he would be liable to blunder in his operation. A line passed through this duct from the nose, would as you see cut the median line of the face upon the forehead, forming with it an angle of about 12 degrees. This line passes just at the termination of the supra orbital ridge, at which point the

handle of the knife should be carried when about to introduce it through the sack. By observing these few simple rules, you may at any time perform the operation, without the risk of pushing your knife either into the antrum or through the os unguis or turbinated bone. I think it will be well again before entirely quitting the subject to call your attention to these meati of the nose and the different orifices opening into them in succession, as this is a point of some importance in pathological conditions of these parts. First then between the superior and middle turbinated bones, running only half the length of the ethmoid bone you have the superior meatus into which only one orifice opens, namely that from the posterior ethmoidal cells. Between middle and inferior turbinated bones running the whole length of the ethmoid, you have the middle meatus, and into it opens two orifices, namely that from the frontal sinus and anterior ethmoidal cells and that from the antrum maxillare. Between the inferior turbinated bone and the floor of the nostril you have the inferior meatus ~~&~~ and into it terminates the communication between the lachrymal sack and the nose.

We have next to notice two other small bones belonging to this part of the face namely the

## Nasal

Bones, forming the bridge or bony part of the nose. These are of a somewhat ~~oblong~~ form, convex upon the outer side, and concave within, being thicker and narrower above than below. They are firmly articulated to each other upon the middle line forming upon the inside a raised ridge called the nasal ~~spine~~ crest, by which they articulate with the nasal lamella of the ethmoid bone. They also have a very firm articulation to the os frontis by a number of spicula from that bone which are ~~also~~ called nasal spines. By their sides they are articulated with the os maxillare, and here again we have ~~another~~ other of these contrivances to increase the strength of an articulation, by the overlapping of the bones. Their inner surface forms the top or roof of the nostril, and has upon it a groove, which as we shall hereafter see is destined for the lodgment of a branch of the nasal nerve. The ~~[illegible]~~, and only

remaining bone of the upper part of the face, for consideration ~~is the~~ except the odd one or vomer is the

## Malar

or Cheek bone, This consists of a body and five processes, namely the superior, inferior and internal orbitar, the maxillary and the zygomatic processes It is articulated with the frontal, sphenoid superior maxillary and by the Jugum with the temporal, bones. Its inner surface forms part of the orbit, its outer the side of the cheek, and its posterior enters into the formati-on of the temporal fossa, This bone is of some import in the operation for desarticulation of the superior maxillary bone, in as much as from being very firmly articulated to it, it is generally considered easier to remove it with the former than to attempt to dislodge it from this articulation, The superior orbital process of the malar bone is articulated partly with the frontal and partly with the sphenoid bones and forms the outer boundary of the orbit, The internal orbital plate or process forms the side of the wall of the orbit, and the inferior orbital process forms a greater part of the lower boundary of the orbit and terminates just over the orifice of the infra orbitar canal, The maxillary process is that by which a firm articulation is had with the outer side of the maxillary bone, and the zygomatic is that by whi-ch it is attached to the zygomatic process of the temp-oral bone, forming by their junction the jugum or yoke under which the temporal muscle passes, Now as you may see by taking this bone along with it, a disarticulation of the ~~superior~~ maxillary bone is by no means a very difficult task, for you have only to divide this jugum and the junction of the palate bone to get it entirely free upon the outside This malar bone is perforated near the orbit by a foramen which transmits a nerve from the side of the face into the orbit, and also a small artery We now come to the last bone of the upper division of the face, to wit the

## Vomer

Or ploughshare bone, and this we find to be a small and exceedingly thin bone, which when in

Pathology of Vomer — After the Ethmoid the vomer is the bone the most frequently attacked with syphilitic necrosis; which is brought on in two ways, 1st by the destruction of the periosteum caused by the presence of tertiary sub-mucous tubercles, 2d by the direct affection of the bone. In both cases however a sequestrum is formed (?) which is not long in being eliminated — When the vomer is necrosed (if the necrosis be complete) the nose falls in, the nares turned directly forward, instead of looking downward & the tip of the nose mounts upwards; (The vomer may therefore be considered as the prop to the bridge of the nose — In secondary Syphilis another part of the nose suffers the alae which are frequently destroyed after cicatrisation the tip of the nose then turns downwards & the organ becomes crooked; When the tertiary symptoms settle upon the vomer the patient is seized with frequent nocturnal headaches & sharp pains at the root of the nose, increased by pressure if the front part of the vomer be affected — Ricord Lancet May/48 &c

situ, forms a considerable part of the septum between the two sides of the ~~nostril~~ nose, at the posterior part it is considerably thicker than in front, and presents thus an extended base for articulation with the rostrum of the Sphenoid bone, The superior part is articulated with the posterior part of the vertical lamella of the ethmoid bone, leaving a triangular shaped space in front which is filled up by an extension of the cartilaginous septum between the anterior nares, This is the part so frequently perforated by Syphilitic affections or ozena, and constitutes the smooth surface which is felt by introducing the finger into the nares, This ~~bone~~ septum is very frequently found out of the middle line projecting into one or the other of the nostrils, so frequently does this happen that it rare to find a case in which the middle line is strictly preserved, This will become very manifest when you come to introduce instruments, in operations upon the eustachian tube, finding very often that one nostril will admit of a good sized catheter passing with ease whilst upon the opposite side you may have the greatest difficulty in introducing a small one, These notches and irregular openings which you see in the bone are not produced by ruptures but are the result of a suspension of development, being found in a great majority of cases, The lower edge of this bone is articulated with the ridge formed by the junction of the two palate processes of the upper maxillary bone, and that of the palate bones forming ~~the~~ entire separation between the posterior nares, We now come to the description of the single bone which forms the lower division of the face, making up the fourteen bones, to wit the

## Inferior Maxillary

Or lower jaw, which need not occupy much of our time as its construction and general conformation from its situation is familiar to all of us. It consists of a mental protuberance body and ~~ramus~~ thrones; by the base of the jaw, which is often spoken of, we mean the lower part of the body, and by the mental protuberance, that part which constitutes the chin in the White races, the blacks having generally a recession of this portion, more like that of some animals.

The ramus is all that part which from being hory-
-ontal turns to reach the point of articulation, and
the point at which such turning occurs is called the
angle. At the top of the ramus we have a semilun-
-ar notch, converting it into two parts or processes,
the posterior one is the condyloid process and has at its ex-
tremity the articulating surface which fits into
the glenoid cavity of the temporal bone, - the other
~~from being~~ sharp at its point and from overlooking the articulation ~~bearing some resem-~~
~~-blance to the beak of a bird~~ is called the Coronoid
process. There is another process or set of processes in
which the teeth, eight upon each side are lodged,
and these are called the alveolar processes.
This bone is developed in the foetus in two parts
which are joined together ossified ~~in front~~ one year after birth during early life
by cartilage, just as the symphysis pubis exists
in adult life, which is therefore, although becoming
ultimately, or about one year, completely ossified, called still the
symphysis, and when the jaw is broken here it is
said to be broken at the symphysis. In this early
state of the bone as the teeth do not exist of course
the alveolar processes which constitute their sockets
are also absent, but the whole bone at this time
consists in little else than a bony shell in which
the germs of the teeth are lodged. Upon the outer
surface on each side of the chin we find the anterior
dental or mental foramen for the transmission
of an artery vein and nerve to supply the soft parts over the chin ~~teeth~~.
In the space between these foramina and the symphy-
-sis we have some depressions for the origin of small
muscles which we shall hereafter have occasion
to notice. Posterior to the foramen we have a ridge
leading from the base of the jaw to the Coronoid
process, behind which passes up, sometimes grooving
the bone, the facial artery in its course for distribu-
-tion. This is so easily come at in this situation
that in operations about the face, pressure may
be made by the finger placed upon it to prevent all
hemorrhage. Upon the inner face of the bone, we
first notice a depression for the submaxillary gland
which may be readily felt beneath the skin by
throwing the head backward and outward.

for the muscle

And next, a ridge above this fossa called the mylo hyoid ridge, the anterior part of which gives origin to a muscle of that name, and the posterior to a part of the middle constrictor of the pharynx. Just below this ridge we have a groove for lodging the mylo hyoid nerve, and at its posterior termination the posterior dental foramen, for the inferior maxillary artery and nerve, which run in a channel between this point and the anterior foramen, giving off branches to each tooth as they pass as may be seen very distinctly upon this large preparation of the arteries and nerves of the part, — before the main branches leave the bone by the foramen they the send twigs to the incisor teeth and to anastomose with those from the opposite side. As the internal pterygoid muscle has its insertion as may be seen by the rough depression in such a manner as to play upon this portion of the bone, and as there would have arisen great inconvenience from pressure of the dental nerve by the action of this muscle, its entrance is overhung by a process of bone, a ligament from which is attached to the styloid process of the temporal bone. Upon the inner side of the chin we have two tubercles sometimes four forming, between them what is called the crucial depression, for the attachment of the fraenum of the tongue and hyoid muscles. The whole outer face of the ramus is covered by the masseter and temporal muscles, from which circumstances you seldom have fractures taking place in these parts, but more ordinarily in the body of the bone as being the most exposed to blows and accidents which occasion fractures. The angles of this bone vary greatly with the individual specimens according to the age of the patient, as you see in the specimen in my hand taken from an individual known to be 120 years old, where they are almost entirely obliterated. This appears to occur from the action of the strong muscles insertion into it acting in the absence of the teeth immediately upon the angle without being resisted by the firm support which they give in the middle periods of life, for they are also much wider in young children before the teeth are developed. This I believe is all that is important to be said upon the bones of the head, and when I meet you

again, after a few words on the general conformation of the head and its angles and measurements, we shall proceed to the study of the vertebra

Lect. IX.

When we examine the skulls of the different varieties of the human race, and of different animals, we are struck at once with the great difference in configuration which the different specimens present. Here for instance, I exhibit to you the extremes of difference in the human family, as it were, a difference which will be at once recognised by all. Now the great family to which both of these belong form not only one Class or genus, but a single species, being but the different varieties of that species, for according to all the great authorities the whole of the tribes of man whether savage or civilized, constitute but one grand link or species in the great Chain of Creation. These varieties consist, according to the great historian and philosopher Cuvier, whose classification is the one generally adopted, - of Circassian, whose descendants are recognised in the civilized portions of Europe and their progeny, and whose rounded contour and full fair front, described by Milton as belonging to our first parents, so strikingly contrasts with the contracted, retreating forehead and projecting face of the African race, - Of the mongolian variety, which ranks as second in point of intellectual capacity, although presenting a few individuals of great capability as Festz Borsch the celebrated botanist who with other great men, belonged to the mongolian race, - Of the Mallay variety which is still inferior, - and lastly of the Native American and African tribes which hold the lowest rank in point of intellect. The description of the descent of all these varieties need not however occupy us, belonging rather to the physiologist than to the anatomist, we shall therefore content ourselves with a brief view of some of the measurements which have been instituted as a means for judging of these capacities and the dependence which should be placed upon them as such.

The first of these is that which was proposed and used by the Celebrated philosopher and naturalist Camper His method Consisted in drawing a line from the exter-nal auditory meatus on a level with the floor of the Nostril taking the direction of the base of the cranium and a second line from the most prominent portion of the forhead upon the median line, to intersect the other at the projection of the lower jaw, These two lines as you see form an angle which will be more or less open as the forhead and supermaxillary bone are more or less prominent, This angle in a well formed Caucasian head is found to be about 80° although it varies so much in individuals belonging undoubted-ly, to the same race, as much to impair its usefullness even as an approximate guide, depending as it eviden-tly must, so much upon the developement of the frontal sinuses and the incisor teeth, being much wider in Children than in adults, Now if we apply the same rule of measurement to these ethiopian crani-ums we find the angle to be about 65 or 70°, and in the mongolian and Malay it is about 5° more A great portion of this difference is made up by the projection of the lower portion of the face, making an approximation to the muzzle of an inferior animal, as well as by an absolute diminution in the capac-ity of the cranium; this will be at once seen by carrying the measurement down to the lower order of animals, as the orang outang and monkey in whom it is found to be only 55 or 60° and in the smaller of the monkey tribes even to 30 or 40° This rule ther-efore, although interesting in its application as a matter of Curiosity or speculation is not to be relied upon in consequence of the infinite varieties in the same race, as well as the obstacles to its adaptation before mentioned, If we apply it the still lower orders of animals, - the sheep for instance, - the skull of which I hold in my hand, we shall find it red-uced to almost nothing, There has been another angle proposed by which to measure the same Capacity of intellect, which consists of drawing a line from the lower outer part of the orbit to the margin of the forame magnum of the occipital bone intersecting another

drawn immediately through that foramen from front to rear. This is called the posterior or occipital angle of Daubenton and can only be taken upon the dried bone, it is as you see very large in the sheep, much less so in man say 70°, This mode however is more fallacious than the last on account of depending so much upon the situation of the condyles for articulation with the first vertebra. The celebrated Blumenbach has noticed as a means of judging of this same capacity the relative narrowness of the forhead when viewed from the back part, - that is its narrowness relative to the back part of the head, where are seated the organs of the animal instincts, and the difference in this respect between this which is the well formed skull of an italian and the other by its side, that of an old african woman, This method is the norma verticalis of Blumenbach, Baron Cuvier has also established another means of computing the capacity of the skull, namely by computing the comparative area's of the different varieties of cranii, with regard to the area's of the bones of the face, in a vertical section of the head through the median line, and he found that in the well proportioned Caucasian skull, that of the cavity was four times that of the face, whilst in other varieties they held a different 15th lect. proportion, A better guide than all these however is that beautiful method proposed by Tiedeman and so successfully adopted by professor S G Morton of this city, consisting in filling the cavity with sand or some other such material and then comparing the quantitys required for different specimens, By this test the Caucasian cavity was found to have the greatest capacity and to have that capacity the best proportioned, There are none of them however of very great importance rather philosophical reveries, than facts of physiological value for as the intellectual part of the brain is supposed to be the cortical portion, the quantity of this as determined by the depth and number of the convolu-tions must be the only approximate indication, and of these no man can form an accurate judgment without having the organ exposed under his eye, and more than all too does this intellectual capability probably depend upon a just and proportionate organization

of the different parts, One remark I will make in addition, upon the configuration of the skull, before leaving the subject, and this has regard to the tempor-al fossa, which we do not find in the head of the child, but is developed in proportion as it becomes older and exercises the muscles which occupy this part giving great probability to the view which was first promulgated by old Monroe of Edinburgh, namely that these depressions are caused by the pressure which these muscles exert upon the bone, The dimensions of the cranium vary very much as well in individuals of the same variety as in those of the different varieties the mean diameters being however for the antero posterior 5½ to 6 inches, for the transverse 5 inches, for the anterior transverse or between the temporal fossæ 4½ inches, and for the vertical through the foramen magnum 4½ to 4¾ inches, which are those given in the best computations We next proceed to the study of the bones which support the head, the aggregate of which constitute the

Spinal column

so called from the processes upon the posterior portion of each bone constituting a ridge or spine down the back, the separate bones ~~entering~~ into the formation of which being denominated vertebræ from the motion which they execute, These are divided into true and false, the latter being so called from not exercising any motions as the true ones do, There are twenty four true vertebra which constitute the whole upper part of the column, being terminated below by the sacrum and coc-cygis which constitute the false. All the true vert-ebra have points in common with each other, and also points of distinction, through which we shall go as briefly as will comport with a good knowledge of this important structure, The bodies of the vertebrae In the first place their structure is very light and spongy as you may see by the sections upon the table, being composed of an internal porous structure, called as in the bones of the cranium, medullium or diploe, which is filled by blood vessels, rendering them exceedingly vascular, - and by a thin shell of compact bony substance around it, We find that with one excep-tion the all have a large foramen behind the body

of the bone for the lodgment of the spinal marrow, with its various arteries and nerves. From each side spring out backward a pedicle or foot stalk from which arise first one process looking upward, another downward which are those called the oblique and which are for articulation with those above and below, and then immediately from the roots of these we have arising one which takes a lateral trans-verse direction which is called the transverse pro-cess, making &c, ~~&c~~ From the common junction of these we have a broad layer of bony matter proceeding inwards and backwards, called the lamella, from the junction of which from either side springs the spinous process, Thus we see that the whole bone is very irregularly shaped, being originally developed in the foetus from seven diff-erent points of ossification, In the bodies of each we have several foramina exclusive of the large opening for the spinal cord, Thus you see upon the posterior part of the body of each several of these which are for the lodgment of the diploic or vertebral vessels, making the whole column exceedingly vascular, which it is of some importance to know in order to account for the frequent and rapid occurrence of caries and necrosis in the part, giving rise to what is called Potts disease, These vessels all open into the spinal canal where they form very free anastomoses with each other, thereby preventing a congestion of any particular set, whereby pressure might be made upon the cord, and forming upon each side of it a chain of sinuses called the vertebral sinuses posterior and anterior, Into these sinuses, which I show you upon these beautiful drawings, and which are 24 in number upon each side of the cord, empty also some of the veins of the cord We next come to notice the peculiar features of these different vertebra, and they have been individually described with so much precision as to enable the anatomist to say, upon seeing one, exactly which one it was, but for such an exact knowledge I have no ambition, The whole of the true vertebra are divided into three distinct

sets, from the different positions which they occupy. Thus we have the seven upper ones called Cervical from their forming the neck; the twelve succeeding ones are called dorsal from constituting the back; and the remaining five are the lumbar, from their occupying that position or region. Now there are characteristic qualities belonging to each of these sets of vertebra, which we shall by contrasting them be able to point out clearly. First then you see the bodies of the cervical, are small flat and somewhat oval transversely, with a kind of epiphyseal margins developed at the sides of the upper surface and upon the back and front of the lower one. By this peculiarity their articulation with each other is by a kind of dovetailing which renders it exceedingly difficult, if not impossible to produce a dislocation without fracture, nevertheless there are some cases said to have occurred in which this has taken place; this interlocking is one of their principal distinguishing features and one of the most beautiful examples of the adaptation of particular parts to the contingencies of injury circumstance. We notice in these also an increased size and oval shape of the canal for the cord, in distinction with that of the dorsal, - and of this too we may at once see the necessity when we consider the motion which belongs to this region, and the bad consequences which would be the result of pressure upon this important organ the spinal cord by such motions. Now we see in the dorsal vertebra the bodies thicker, of a more triangular shape, - without any elevations upon their margins, and the spinal canal much smaller and more round; in the lumbar, we see the bodies large, thick and presenting an oval shape, with a larger spinal canal, not that the size of the cord increases as it descends and distributes its nerves, - but here again we come to have considerable motion exercised, in which if the size remained the same we should run the risk of pressure, for it is in this region that we have the principal part of that motion exercised which constitutes suppleness. We next come to the peculiarities of the processes, and first of the spinous processes. In the neck we see these short thick and bifid

for the insertion of muscles, inclining very slightly downwards, — in the dorsal we have them long and tapering, and inclined very much downwards, over-lapping each other like tyles upon the roof of a house, or scales upon the back of a fish, — in the lumbar, they are short and straight, broad and flat from above downwards, and very strong. With regard to the oblique processes, those of the cervical portion are strictly oblique, presenting their articular faces somewhat inwards from above allowing of a sliding motion upon each other, — those of the dorsal region present their artic-ular faces nearly vertical, being destined to the exercise of little motion on account of the sup-port which they must give to the thorax, those of the lumbar portion although vertical are so calculated as to give considerable motion, for the superior facets instead of looking towards each other as in the dorsal, — look outwards forming a concavity for the reception of the inferior processes and thereby resemble a common ball and soc-ket joint which of course admits of considerable motion, The transverse processes also differ very much in the different regions, in the cervical, we see them short and bifid for the insertion of musc-les, being perforated at the base by a foramen which transmits the vertebral artery as you see in this preparation, and here we have a singular exemplification of the law of order which prevails throughout the operations of nature; it is that although this artery, except in very rare cases, always enters this canal between the sixth and seventh vertebra, yet the seventh is found to have its transverse process perforated like the rest, In the dorsal region these are long and stand out at right angles to the column, having tubercles with articular facets for the junction with the tubercles upon the corresponding ribs by which they form for these a kind of abutm-ent, In the lumbar vertebra we have the trans-verse processes very long as well for the attach-ment of the various lumbar muscles, as to serve

in some sort, the function of ribs, in the affording protection to the abdominal viscera, These then mark the distinctive characteristics of the different classes of vertebra, and we must next turn our attention to the means by which they are fastened together ~~by~~ This is effected by a strong ligamentous elastic tissue, composed of fibres which pass from one bone to the other in an oblique direction, so strong and elastic is this substance that as you see in this specimen, a knife thrust into it, is forced out again by the elasticity, this tissue extends to the depth between the bones of about 3/8 of an inch around the whole circumference, leaving a space in the middle which is filled up by a spherical mass of gelatinous or pulpy substance which being entirely confined by the fibrous structure around it constitutes a kind of ball and socket joint, This arrangement is especially perfect between the eleventh dorsal and the second lumbar vertebra where we have the greatest amount of flexion performed, Of the almost incalculable strength of these tissues it is hard to form an idea except from the great necessities of protection to the spinal cord, and support to the whole of the upper part of the body. The elasticity of this structure has been alledged to exercise some influence upon the stature at different periods of the day, thus, it has been said that we are somewhat taller upon arising in the morning, than on going to bed at night, in consequence of the constant pressure during the upright position causing a compression of these interposed ligaments, which during the repose of night regain their elasticity to the fullest extent. Upon the anterior part of the bodies of the vertebra I call your attention to a strong band of ligamentous fibres extending the whole length of the column and attached to the intervertebral ligaments of each space, and also to another of exactly similar construction and attachments upon the posterior surface of the bodies, and within the spinal canal, these are called the anterior and posterior common ligaments of the column

**Lect. X.** I propose to day to call your attention to some of the individual peculiarities of the bones constituting the vertebral column, And first of these to the first vertebra or Atlas as it has been called, from its supporting the head, The first and great distinguishing point in this bone, is the absence of a body, consisting merely in a bony ring, or as commonly described, of two bridges, one of which is formed something like that of the other vertebra, the other standing in the place of a body, which is represented by a tubercle upon the arch, You will notice that the space between the bridges, or the passage for the spinal marrow is very large compared with those below; we moreover find the transverse processes, of 2d vertebra thicker and longer on account of having to act as levers for the insertion of several small muscles connected with the motions of the head, to which this lengthening of the arm of the lever gives an increase of power; the spinal process is also different being short straight and thick, being in fact a kind of bifid tubercle; You will also notice a groove here upon its edge near the root of the transverse process made by the direction which the vertebral Artery here takes, It ascends vertically through the other foramina until it reaches the atlas when it takes a horizontal direction along this groove to reach the margin of the occipital foramen and then turning again at right angles gains the foramen and ascends to be distributed to the brain, And this tortuous course is perfectly analagous to that of the Carotid artery before spoken of, and fullfils the same purpose, namely, to diminish the shock or pulsation upon the brain, The oblique processes also differ very much from those of the other vertebra We find them shaped to correspond with the condyloid processes of the occipital bone, and indeed they may be considered as true glenoid cavities for the reception of these condyles; their surfaces are concave; their margins elevated, and their direction inclined inward so as exactly to adapt them to that nodding or occilating motion which alone they are capable of, those of rotation being perform-ed entirely in the joint below, Their inferior

oblique processes are however more horizontal as of necessity must be the case, to admit of that sliding motion necessary for rotation which as before mentioned takes place between them; these are also somewhat excavated in the centre for the reception of those of the dentata with which they articulate, We next notice inside of the bridge opposite to the tubercle before noticed a smooth facet for articulation with the tooth like process of the next vertebra below; this facet is encrusted with cartilage and furnished with a synovial membrane which is common also the process of the dentata, making it a freely movable articulation, Upon each side of this facet you will remark this tubercle which is intended to give origin to the transverse ligament, Surrounding the articulation of the Condyloid process with the glenoid Cavity of the atlas we have a complete Capsular ligament, as you may see upon this recent preparation, and this is lined by a proper synovial membrane giving freedom of motion to the joint, in addition this Capsule we have this bone connected with the occipital by a strong band of ligament in front, called the anterior occipitoatloid ligament, and also one behind called the posterior occipito atloidian ligament, Here I show you the strong band which passes across behind the articulation of the dentata from one tubercle to the other; this is called the transverse ligament of the atlas and has the effect with others to be mentioned of keeping the tooth like process in its place, and preventing its exercising a pressure against the cord which would be instantly fatal, The rupture of this ligament under ordinary circumstances is if not impossible at least of very rare occurrence, and when so occurring must produce instant death, This is sometimes understood by those about to be executed by hanging, and they therefore, by using a long rope and a considerable fall endeavour to produce this effect, and secure a quick death, otherwise hanging is merely death from suffocation & shock The second cervical vertebra or vertebra dentatta as it is called from the tooth like process with by which it articulates with the atlas, is also remarkable in some respects,

It has a body of a peculiar shape from which you see arises the tooth shaped process which has been spoken of as being articulated above, The bridge of this bone which surrounds the spinal cord is exceedingly strong and its spinous process short strong and bifid as you see; the transverse process however is not bifid, and is much shorter than those of the atlas; the passage for the spinal marrow is very large although not quite to the same extent as that of the atlas, The necessity of this apparent excess of room in this region of the canal must be very obvious when we consider the extent of the motions of these bones and the disastrous consequences which must follow any compression of the contents of the canal, The dentate process of this vertebra is held in its place not only by the transverse ligaments of the atlas but by three other ligaments called the moderator ligaments by which it is connected with the occipital bone, and which also serve to limit the motion of this bone, We may readily see that if no arrangement existed to limit the side motions of the atlas upon the dentatta, they might readily be carried to the extent of compressing the spinal cord, I have here by these three strips of red velvet endeavoured to exhibit the situation and actions of these ligaments more distinctly than could be done upon the preparation, You see that the two lateral ones arising from the sides of this process go to be inserted upon the margin of the occipital foramen, in such a manner that when the head is strongly turned to one side, the ligament of the opposite side is made tense and prevents farther motion in that direction, This occurs of course in the same manner upon the opposite side and thereby the motion both ways is limited, The middle ligament represented by this middle strip, arises as you see from the top or point of the dentate process, and goes to be inserted upon the anterior margin of the foramen magnum, merely acting as a stay to keep the process from slipping down when the head is supported by other means and also to assist the transverse ligament in its

office, This is called the ligamentum suspensorium or Medius Rect-us, By means of these several ligaments and the Capsules around the oblique processes, the motion is reduced in its extent from the freedom with which it is executed in the dried specimens, to ~~that~~ within the limits both ways but not more than the 24th part of a circle of 1/6 of a circle, the remainder of that which is enjoyed being contributed by the slight addition which each of the other articulations affords, In their action upon the head these small ligaments bear great analogy to the Crucial ligament of the knee joint which as we know limit the motion to one direction almost entirely, There exists here also, another ligament of a very strong character call-ed the posterior occipito axoid, which arises from the margin of the occipital foramen and extends down to the axis being there continuous with the common posterior ligament of the spine; from which it cannot be distinguished and therefore should not be described under a different name, as all these divisions where none naturally exist only tend to confusion, This ligament does not however consist of fibres which extend the whole length of the column, but is made up of those of various lengths, some arising from one vertebra and being inserted into the next below, others extending across two or three vertebra, and so on, and this arrangement holds good also with regard to the anterior common ligament, whose function is also the same, These ligaments frequently become ossified in aged persons, and of course limit or destroy the flexion and extension of the back in such, to a great degree, It only now remains to call attention to the gradation of one set of vertebra into another, as you see that as the cervical approaches nearer to the dorsal region, the character of the vertebra is gradually changed to those of that region, and the same is true with regard to the change from the dorsal to the lumbar region, the last of one class bearing a great resemblance to the first of the other as you may see, The ~~Seventh~~ 6 vertebra of the neck is marked as you perceive by the prominence of its spinous process; which may any time be distinguished under the skin, On account of this it has been

called the vertebra prominens, and upon it we are in the habit of making pressure in examination of the condition of the cord as to health or disease. I have stated before that the spinal column was pyramidal in its form, gradually increasing in size as it ascended, and this although correct as a general statement, has an exception in the four upper dorsal vertebra which decrease in size as they descend. The last lumbar vertebra differs from the rest in its body being bevelled off at the expense of the posterior portion, so as to assist in the formation of that projection known as the promontory of the sacrum. The spinal column as a whole consists of a series of accomodating curves, which are formed not ~~by~~ altogether any variation in the form of the bones, but mainly by a modified thickness in the intervertebral substance, thus in the neck whose inclination is slightly backwards these layers are thicker in front, whilst in forming the concavity for the viscera of the thorax and abdomen they are thickest posteriorly; this point is of no particular importance, and may be readily understood by the application of the laws which govern curves. The manner in which the various deformities of the back occur may next occupy us for a moment or two, and in connexion with this subject I would call your attention to the skeleton which is suspended here. This was a case in which this great deformity or curvature occurred from what has been denominated Potts disease of the spine from the celebrated surgeon who first fully described it. It consists in a caries of the spongy portions of the bodies of the vertebra which as you know by this time are very light and exceedingly vascular, and from blows, falls, or constitutional affections as scrofula and other affections of the nutritive functions, very liable to disease of a character which once established is very hard to control or eradicate before having gone to the extent of producing deformity, and often death. Now when caries attacks a bone it will of course make more progress in the spongy or cellular part

of the structure than in the more compact portions and this from two reasons; first because that part being more highly supplied with vessels and nerves is of course more highly organized and secondly because having less firmness it can present less resistance to the decaying influences, we therefore have the bodies softened down and absorbed, whilst the oblique and other processes remain either unaffected, or affected to a degree so slight as not to modify the space which they occupy. This of course will cause an outward or upper curvature as has taken place in the specimen before us, and this curvature will be limited in extent in correspondence with the extent of the disease and the number of vertebra involved. In a case the preparation from which I here exhibit to you, this curvature has taken place in several directions, so modifying the condition of the surrounding bones, and so displacing the viscera of the cavities as to make it a matter of great wonder how the being could exist at all in such a state of contortion. You see that the heart is entirely displaced, being tilted up as it were so as to be almost on a plane with the horizon, and the ribs are elongated and distorted to a surprising extent. And yet this individual, small as the preparation appears, lived to the age of 18 years. Death occurs in these cases from various causes; sometimes from debility or induced hectic, sometimes from interference with the functions of the spinal cord, and sometimes from the displacements which the viscera undergo. Between the bodies of the dorsal vertebra may be noticed, with the exception of the first and the two last, a series of articular depressions for the heads of the ribs, one half being upon each side with the exception of the first which has an entire facet, and also the eleventh and twelfth. I may here mention that we have between each of the oblique processes ~~extended~~ a complete articulation with its cartilage, capsular ligament, synovial membrane and all, as you may see in this recent preparation, presenting when opened the characteristics of perfect joints, the motion between any pair of which, however, being extremely limited, whilst that of the whole

series is by no means so. We have also as I am better able to exhibit to you upon these enlarged drawings, a number of connexions between the spinous and transverse processes. These are formed of that peculiar yellow elastic tissue of which I spoke when treating of the ligaments in general, which is known as the tissue jaune. These are called the inter spinous and inter transverse ligaments of which there are in all 23 pairs. They are extended between the bridges, transverse, oblique and spinous processes in pairs, as is well exhibited by this beautiful drawing forming as it were a continuous connexion between all the vertebrae; this ligamentous tissue is exceedingly strong and elastic, having for its office, the bringing back, or the aiding in bringing back to their exact position, the parts after having been flexed by the action of the muscles; thus when we stoop it is by the action of the abdominal muscles putting these upon the stretch, and as soon as this force of the muscles is removed their tendency will be towards extension of the column. We now come to the consideration of the bones forming the cavities of the thorax and abdomen which are in connexion with those of the spinal column, namely,

## The Ribs.

These as you know are generally 12 in number on each side, sometimes however there are only eleven, at others thirteen, - and are named numerically from above downwards. The first is the broadest, thickest, and strongest, and from it they increase in length to the seventh or eighth after which they decrease to the twelfth which is short thin and somewhat pointed. They are generally convex upon the outside, and flat upon the inside so as to present a smooth surface to the viscera which they contain; they consist of a body, head, neck and tubercle. The head of the first is received as before mentioned into a facet or cavity in the body of the first dorsal vertebra, and the eleventh and twelfth are also received into depressions in the corresponding vertebra, but all the rest are articulated between the bodies of the vertebrae one half with the upper and the other with the lower

one, Upon the head of each of these is a transverse ridge upon which is attached a ligament connecting it with the intervertebral substance, called the inter articular ligament; this converts the articulation into two separate joints, each having a proper synovial membrane; this may be seen upon the recent preparation, but is better shown upon this large drawing, At a short distance from the head you see a raised eminence upon which is a facet for articulation; This is called the tubercle, and corresponds exactly with the facet upon the transverse process, with which it articulates, - all that portion between the head and this tubercle is called the cervix or neck and is occupied by ligaments &c. The capsular ligament of the first articulation is you see radiated in front forming three bands which are attached to the bodies of the vertebra, Here you also see the ligaments of the articulation between the tubercle and the head of the transverse process, which is called the costo transverse; the first being the costo vertebral; there is also another ligament by which one rib is connected to the transverse process of the one above it and this is called ~~the~~ ligamentum cervicis costarum, This manner of junction with the spinal column admits of no motion in the ribs backwards or forwards, but limits it to a slight extent and that in an upward direction, When we look upon the naked bones of the thorax we always see them in the condition in which they are after expiration, having their obliquity at a maximum, now when the chest expands, this obliquity is not so great on account of the ribs being drawn up nearer to a level with their articulation and by their concavity adding materially to the capacity of the thorax, In this manner of enlarging the chest, the cartilage which providentially fills up the space between the ends of the ribs and the sternum, exercises a very great influence, owing to their flexibility and elasticity which is then brought into play, but of this and the manner of their articulation with this cartilage I shall have more to say when I shall have the pleasure to meet you again on monday.

Lect. XI.

At the last lecture you will remember, that we were engaged with the osseous structure of the Thorax, and noticed some of the peculiarities of form and direction of the Ribs, - their division into head neck and body tubercle, and the purpose fulfilled by the articulation of the tubercle with the transverse processes of the vertebra, To day we notice first, that of the ribs, only the upper seven are articulated with the sternum by direct cartilaginous continuation and these from this reason are called true ribs, whilst the five inferior are called false, three of which have communication by the intervention of the cartilage of the seventh Rib The two lower as you see, are short and tipped with cartilage but have no connection with any thing except the muscles of the part, and are therefore called floating ribs from their freedom in the abdominal ~~cavity~~ parietes, The whole of the lower five assist in forming the walls of the abdomen as their principal office, the lower two indeed being entirely below the thorax, The three upper false ribs have a cartilaginous extension to the sternum by the union of the lower by its cartilage to the next above it and that in the same manner with the first, - this again being united to the last true one by the same means, These unions consist of perfect articulations having synovial bursa between each, so as to admit of a sliding motion ~~between them~~ when the ribs are raised in inspiration, whereby the cavity within is enlarged, The Ribs are generally incurvated or twisted in such a manner as to resemble somewhat the italic S, This incurvation is not confined to one direction, so that you find upon laying a rib upon a flat surface it will only touch at points, By this means they are accomodated to the conical form of the chest, which is exactly ~~performed~~ preserved, ~~whether~~ without the occurrence of inequalities ~~of~~ surface which would otherwise occur during the rocking motions which they execute in inspiration and expiration, You see upon this preparation, how smooth is the concavity which they form for the organs of the thorax, and how regular is the convexity upon the outside, ~~and~~ both of which are, by the form of the bones, and elasticity of the cartilage

Between the cartilage of the seventh rib & the Sternum, there is a fossa called super-xiphoid, that we can feel in the living subject

preserved, alike in elevation or depression,
Upon the posterior ~~portion~~, at the inferior margin of each rib we perceive this groove, upon the outer side of which there exists a marked ridge, and one upon the inner side not so pronounced, This groove is for the lodgment of the intercostal vessels and nerves and the ridges give origin to the two layers of the intercostal muscles, Thus we have the vessels at the posterior inferior margin of each rib (except the first and the last two,) and between the layers of the intercostal muscles, This is very important to be remembered, because in cutting down to tie these vessels, you are not to cut through both layers of the muscles, which would expose the pleura, and make it liable to be wounded, but look for the artery between the two, This is a very difficult operation to perform from the liability to open the cavity of the chest, the introduction of air into which would produce very serious consequences, This groove which is for the protection of these vessels is only found at the posterior portion of the rib, because after having proceeded forwards and thrown out branches, they divide and become so small as not to be important, This division we shall have to notice at a future day and therefore need not now take up time with detail, At the posterior part of the body of each rib you may perceive a point at which the bone curves forward with more acuteness, than at any part of its course, This is called the angle of the rib, and occurs at a greater distance from its head as you descend towards the lower ~~ones~~ where it is lost ~~in those short~~ ones, where it is entirely lost, As you may see, it occurs above at the tubercle, lower down upon the ~~one~~ it is further out, and so on, This arrangement is for the accommodation of these ~~broad~~ large muscles of the back, affording them space for origin and insertion, namely the sacro lumbalis and longissimus dorsi,
The upper margin of each rib is somewhat rounded for the attachment of the intercostal muscles, and the external surface presents a regular convex smooth ~~surf~~ attachment for the muscles of the upper extremity, We are next to consider the bone to which the cartilages of the ribs are attached,

# The Sternum

The attachments ~~of~~ which, of these cartilages is more oblique as we descend from the first rib, the upper ones being straighter than those below. This bone is so situated as to be intermediate in the line of motion between the lower ribs and the fulcrum which is the articulation between the first rib and the first dorsal vertebra. In the ossification of the ribs the process seems to terminate abruptly at a corresponding line upon each rib and from some inscrutible cause leaves the remainder in the cartilaginous condition necessary for the motions which take place. In old persons however these cartilages are frequently found ossified hence such must breathe almost entirely by means of the diaphragm, which is sufficient to support the decrepid condition of this period of life. Let us now take a glance at the position and structure of this sternum. It is placed here in the middle of the thorax as a kind of breast plate for the protection of the very important organs which it assists in enclosing, as the Heart Lungs &c. It is of very fragile constitution, a section as I show you, consisting almost entirely of Spongy tissue, from which cause it is very vascular and exceedingly liable to carious affections. In this specimen you see Caries has gone to a considerable extent, causing as I have no doubt it did, an extensive abscess behind the bone. From its exposed position and frail character, one might suppose it very easily fractured, particularly when attacked by caries as in this case, but the fact that it is nowhere in a solid bony connection and is in a condition to yield before any force which may be applied, are reasons for its resistance to any reasonable or probable occurrence. This bone in the young adult specimen generally is in three pieces, at a somewhat more advanced period the two lower of these coalesce, and in old age the whole is fused into one solid bone. In the Child however there are many pieces as you may see by this specimen, which are lessened in number as the Child grows older. The ancients compared it to a sword - short & broad such as they generally used -

The first or upper bone is hollowed out upon its inner surface for the passage of the Trachea, leaving at

each of its superior angles a broad articulating surface for the Clavicle or Collar bone, Immediately below this is the depression for the Cartilage of the first rib, and at the inferior angle on each side is half the Cavity for the second, the other half being upon the second bone which also receives the Cartilages of the 3d 4th 5th 6th and half of the 7th, The Shape of this second bone is quite irregular, generally increasing in breadth as it decends The third portion is called the xyphoid or enciforme appendage, from its shape bearing a fancied resemblance to a sword, Its shape however varies very much in different preparations, as you may see by these various specimens. in some being broad and short, in others long and narrow, This sometimes becomes bent outwards and appears as a kind of tumour in the scrobiculus Cordis, Clerks who remain for great length of time bent over their desks are very liable to this affection, You will also frequently be called to manage a similar condition in Children, wherein a gentle pressure will be entirely sufficient to establish a cure, The general configuration of the whole sternum is that of an irregular oblong square lengthened into a point at its lower end, slightly concave within and generally Convex without although the second bone when viewed alone is a little depressed in the Centre, The motion between the two upper bones of the sternum is generally more obvious than in the other articulations, and you see how well this is calculated to increase the capacity of the Chest, the upper Costo vertebral articulation acting as a fulcrum the Sternum and upper Rib being the lever to which the power is applied by the elevation of the lower ribs The Cartilages of the ribs are articulated with the sternum by perfect joints having a capsular ligament furnished with a synovial membrane, These connexions are also strengthened by the strong fibrous membrane which covers the two sides of the sternum, and which constitutes its periosteum, being continued over the Cartilages as their perichondrium, giving to each a close envelope by which it is supported, These articulations are also furnished with a ligament which from an origin upon the Cartilage is radiated upon the sternum, These are called the superior

and inferior costo sternal ligaments, In the articul-ation of the second ribs alone we have an interarticular ligament precisely like that which has been spoken of and exhibited in the costo vertebral articulations The perfection of the joints, and the peculiar manner of junction of the lower or false ribs have been spoken of and may be well seen upon many of these preparations We shall therefore proceed down to the bones attached to the lower end of the vertebral column, which constitute the

## Pelvis.

Which we shall pass rapidly over in as much as the Professor of Obstetrics has so minutely and ably described them in connexion with his branch These, as you are for this reason aware, constitute the bony envelope for the organs of generation in the female, and therefore require your particular attention and study; they also afford firm support for the lower extremities and give great facilities to all the parts concerned in locomotion, The pelvis consists of four bones; two ossa innominata, an os sacrum, and an os coccygis. These are so arranged as to constitute a kind of basin divided horizontally by a narrowing of the bones, into two compartments, the upper being called the upper basin, and the lower the lower basin or lesser pelvis, the upper being also called the greater pelvis, and the line of division being called the superior strait of the lesser or true pelvis. After the fortieth year of life the os coccygis is generally found consolidated with the end of the sacrum, making the pelvis at that period consist of only three bones instead of four, The os innominata is divided in the foetus into three distinct bones, which sometimes continuing separate or marked out in adult age has given rise to their still being described as distinct, They are the ilium, ischium and pubis The first is called

## Os. Ilium

Because the hollow which it forms is partly filled by the part of the intestine of the same name This is a large flat bone the boundarys of which you see marked by these black lines upon the specimen, It is as you see somewhat convex upon

its outer surface which is called the dorsum, and concave upon the inside, which is called the venter or sometimes improperly the Costa of the ilium,
The superior edge which is called the crest, and which is developed as an epiphysis to the bone, - is shaped somewhat like the italic S and presents three lips or facets for the origin and insertion of muscles; the outer lip for the origin of the external oblique muscle the middle one for the internal oblique, and the inner one for the transversalis, This crest terminates in front by two projections or processes the superior and inferior anterior spinous processes of the ilium through the notch between which comes out the internal iliacus muscle, It also terminates posteriorly by two processes which are denominated the posterior superior and inferior spinous processes of the ilium, The superior anterior one is of some importance to the surgeon as it is from this point he measures to ascertain whether a limb has been shortened after fraction, This bone is quite thick at its inferior part and edges, but thin and almost diaphanous in the centre or belly, because here it was not necessary that it should be very strong as as it is covered upon the inside by the thick and
+ strong iliacus internus muscle, and upon the out-side by the greater and smaller glutiei which are three times as thick as the former; The venter is separated from the lesser or true pelvis by a line of thick bone which from the promontory of the sacrum is continuous around the semicircumference of the pelvis, and is called the linea ilio pectinea, from its in-
+ volving the the ilium and the pubis which was formerly called the pectin or comb bone from a supposed resemblance to a comb, This line which forms the superior strait or boundary of the lesser pelvis and which is of great importance to the obstetrician from the influence which its extent has upon the delivery of the Child, should in ordinary be called the ilio pubic line, as we now call the other bone the os pubis in stead of os pectina, I next call your attention in a rapid and cursory manner to the back of the bone, upon which you see the ordinary nutritious foramina by which the bone nourished, and upon

the posterior part an elevated space or ridge which gives origin in part to the Gluteus maximus muscle, The other ridge which you see running from the anterior superior spinous process to the sacro ischiatic notch, with the portion of bone above it not occupied by the gluteus maximus, gives origin the gluteus medius, and all the remaining portion of the bone is appropriated to the gluteus minimus, We next take up for consideration the

## Ischium

which for description is divided into three parts, the body, ascending ramus, and tuberosity, This bone like the ilium enters into the formation of the acetabulum, as you may see by these black lines or by this divided specimen; the body has an outer or dorsal surface, and an inner one which is called the plane of the ischium, which with the other planes and curves of the pelvis, is very important on account of the agency which they exert over what is called the mechanism of labour, We next take cognisance of a somewhat pointed projection jutting backwards from the body of the bone, This is called the spine of the ischium, and besides giving origin to one or two small muscles, forms a pulley or trochlea over which the tendon of the obturator internus muscle plays in making its exit from the pelvis, going to be inserted as we shall see hereafter upon the base of the great trochanter; the belly of this muscle forms a soft cushion upon the plane internal surface of the ischium, so that the childs head in its descent has not only a smooth bone but also a soft muscular cushion to rest upon From the spinous process also arises the lesser sacro sciatic ligament which going to be inserted into the side of the coccyx and lower portion of the sacrum assists in forming the greater and lesser sacro sciatic foramen, The part of the bone which is called the tuberosity is this lower thick portion, which as you see is marked upon its inner face by this ridge upon which the greater sacro sciatic ligament is attached, This portion is divided into three facets the inner of which is occupied by the origin of the hamstring muscles of the leg namely the semitendinosus

Spasm of Levatores which are in compressed prostate

with the long head of the Biceps flexor cruris, and the semimembranosus; the middle space is that portion upon which we rest in the sitting posture being of course well covered by fat and integuments; the outer facet is occupied by the part of the gluteus maximus. This the ascending ramus of this bone, goes to join the descending ramus of the pubic bone, thereby forming a part of the foramen thyroideum on the one side and the pubic arch on the other. We may next occupy a few moments with the ~~os~~

OS. PUBIS

which consists of a body, a horizontal portion and a descending crus or ramus, all of which aid in the completion of the obturator notch or thyroid foramen as it is called, we find upon the horizontal portion the remainder of that line before spoken of as the ileo pectineal line near the termination of which we have a rough raised crest as it is called running from the angle forwardly to terminate in this prominence which is called the spine, This spine and crest give insertion to the lower column of Poupart's ligament and to Gimbernat's ligament, parts which are of so much importance in the anatomy of Hernia. From this crest as you may see, runs out another line to the side of the acetabulum over which the femoral vessels pass to gain the front portion of the thigh These vessels are here found very superficial in so much that pressure over this region will stop the circulation of the limb, It is at this point that pressure is made upon the artery in operations of amputation when the tourniquet is not used either from choice or from the hight of the operation preventing it, It is not however the most safe mode of controlling the hemorrhage and should never in my opinion be preferred to the other, Just where my finger is placed you see the pectineal protuberance over which passes the tendon of the psoas magnus muscle and a part of the iliacus internus to their insertion into the lesser trochanter of the thigh bone Between the bodies of the pubic bones of either side we have a fibrous connexion, not a joint except in some rare cases, but a union by symphysis which I have before explained, There is sometimes said to be motion between these at the time of utero gestation, but this is exagerated as such a condition must seriously interfere with locomotion,

It has been proposed to divide this junction so as to increase the space in the pelvis, in cases of very difficult labour, but I believe no well educated obstetrician of our day ever thinks of such an operation. We have upon the ramus of this bone a grove for the insertion of some of the genital muscles of both male and female as the erectors penis and clitoridis &c. which however will be spoken of at another time. These three bones enter into the formation of the acetabulum in following proportions, namely, $\frac{2}{5}$ from the ilium, $\frac{2}{5}$ from the ischium and $\frac{1}{5}$ from the pubis, nearly the ilium however contributes rather more, and the ischium rather less than the proportion named

Lect. XII.

I propose to commence the lecture of to day, with an examination of the remaining bones of the pelvis, Having already gone over the os innominata, and the three bones which compose it, these from the opposite sides constituting ~~the~~ whole anterior portions of the pelvis, there remains for us now only those which fill up to completion, the back part of the pelvis, namely. the os sacrum and os coccygis, in the description of neither of which shall I be very minute, as they have been so ably spoken of in another place

The **Sacrum**

When regarded apart from its connexions with the other bones of the pelvis, has a somewhat triangular shape, concave and smooth upon its inner surface by which it contributes much to the capacity of the lower pelvis, it is convex and very irregular upon its posterior surface, This roughness is formed by a kind of aglomeration of several vertebra as it were, of which this ~~vertebra~~ bone appears to be a collective continuation, We find for instance that its upper aspect presents a surface for articulation with the last lumbar vertebra, which being like that beveled off at the expense of its posterior part, aids in forming that jutting prominence which is called the promontory of the sacrum, Upon the posterior surface we find four tubercles or projections which seem to be the rudiments of the spinous processes, we also find ridges running across the bone between these, which appear

to have resulted from the solidification of the oblique processes, Thus if instead of having the transverse processes as above, open and separate, with one foram-en between them through which passed both the anterior and posterior spinal nerves to their distribution, - we should have them all solidified into one mass, there would be a necessity for two sets of foramina through which these two sets of nerves might pass, Now this is precisely the condition which obtains in the sacrum, there existing four foramina on each side of the front of the bone and the same number of smaller ones upon its back,

These winglike projections which you see upon each side are for articulation with the ilium, where the form a true articulation, for each bone receives a thin layer of cartilage between which you have a fibrous mass into which some synovial fluid is effused, This although a proper joint, enjoys in the normal condition a very limited if any degree of motion; - which is not of course intended where so much firmness is required, We find the posterior surfaces around this articulation very rough and uneven for the attachment of the sacro ~~sciatic~~ iliac liga-ments, These are exceedingly strong, for the strength of these fibrous connexions is not measured by the length or thickness of each fibre, but by their number, and here you see an inch or more of space upon each bone occupied entirely by them, the posterior sacro ~~sciatic~~ iliac ligaments then are among the strongest in the whole body, and thus capable of resisting more force, You may see here that the spinal canal is continued through the sacrum, from which these foramina come out, but as the spinal marrow does not extend below the lumbar vertebra where it divides into a great number of filaments, this part of the canal cannot be intended to contain it, It contains however the fimbriated or tail like prolongation of it with the membranes in which it is enveloped, This prolongation is called the Cauda Equina from its resemblance to the tail of a horse and from it come out the sacral nerves both posterior and anterior, Below the spinous projections you perceive an angular slit opening into this canal, which at first sight might seem calculated to expose the nerves enclosed within but this is closely covered by a membranous or fibrous

structure like the periosteum of the bone, which protects it as securely as if the cover was of a bony nature. There exists as you may see, appended to the sacrum this small bone which is the os coccygis, the use of which appears to be to continue the concavity of the sacrum and thereby perfect the bony structure of the pelvis, and more particularly to afford insertion to the various ligaments and muscles whose offices it is to support and give strength to the perineum or floor of the pelvis, the great antagonist to the diaphragm and abdominal muscles, This is the representative of the tail bone in animals, and ~~forms of~~ its existence in man forms one of the arguments of ~~Lord~~ Monboddo in endeavoring to sustain his position that the human race are only cultivated monkeys, the only difference between the two beings as he thinks, that the monkeys tail is allowed to grow and stick out behind whilst that of man is hidden beneath the integuments, In the young subject this bone is found to consist of several parts generally of 4 or five, which become consolidated into one as life advances, and the whole, after the fortieth year becoming joined by bony union to the sacrum, When composed of several pieces, they gradually decrease in size as they approach the termination until the last is a mere tubercle, This bone is from its situation as you see by inspecting the pelvis, extremely well protected lying between the tuberosities of the ischium and almost upon a level forwards of the strong point of the sacrum; nevertheless it is occasionally fractured from peculiar causes; and when so fractured is one of the most troublesome and painful affections with which you will have to contend, often keeping your patient in suffering for months before you will succeed in establishing a cure, The occurrence of this accident may be known by the introduction of a finger into the rectum, which with the thumb upon the outside may grasp it and move it in any direction, It next becomes necessary to notice the two little horns by which it is articulated with the sacrum. these are attached to the latter bone by ligaments, which become consolidated in middle life and then form two foramina one on each side through which the

Sitting Student holding coccyx

last pair of sacral nerves come out to be distributed to the parts in the neighborhood of the anus.
We next have to notice the ligaments by which all these bones are held together, and first of these to that arising from the bodies and transverse process of the lumbar vertebra to be inserted upon the posterior part of the crest of the ileum, This is called the ileo lumbar ligament and holds these parts in their relations. The second is one which arising from the transverse process of the last lumbar vertebra is inserted into the sacrum and is called the sacro vertebral ligament. Upon the anterior face of the sacrum arises a thin smooth and strong ligament which passes in front of the articulation to be inserted upon the ileum, whereby the fissure of the joint is entirely hidden from view, This is the anterior sacro iliac ligament and forms the only anterior connexion between these bones. On the posterior face of this articulation you see this large mass of ligamentous structure; this is the posterior sacro iliac ligament and is very thick and strong, In addition to this you have the sacro spinous ligament passing from the posterior inferior spinous process of the ileum to the sacrum below, also serving to strengthen very much the articulation, Next in order come the ligaments attached to the coccyx, and here we have one upon each surface connecting the sacrum with the coccyx, called the sacro-coccygeal ligaments and then come those connecting these bones with the ischium, Here we have a long ligament arising from the posterior part of the ileum and nearly all of the sacrum which after being folded or condensed in its middle goes to be inserted upon that edge upon the inner side of the tuberosity of the ischium which I showed you on another occasion, This is called the great or posterior sacro sciatic ligament and converts the sacro sciatic notch as you see, into a great foramen by extending across its opening, Another shorter one extends from the lower end of the sacrum and the whole length of the coccyx, becoming narrower, to be inserted upon the spine of the ischium, This is the anterior or lesser sacro sciatic ligament and goes upon the inside of the former, Upon the upper face of this ligament you see some mus

-cular fibres running in the same direction, thus consti-tute the Coccygeus muscle. This ligament by crossing the greater one in an oblique direction, divides the large foramen formed by it into two, a greater and smaller sacro sciatic foramen. Through the greater one pass out the the pyriformis muscle with the gluteal vessels and nerves, and through the lesser passes the ~~obtu~~ tendon of the obturator muscle on its way towards its place of insertion, the pit at the root of the great tro-chanter. Thus you see this muscle which has its origin from the inside of the Thyroid foramen, has its action in a very different line using the spine of the ischium as a trochlea, its action is to turn the foot outwards. We must notice the manner in which the Thyroid or oval foramen is closed except at its upper part by the Obturator ligament, which is very firm and strong. From the greater part of this ligament arise the obturator muscles one upon the inside the other upon the outside. You may observe near the top of this membrane an opening for the obturator vessels and nerves to pass out. This in the case before us is very well guarded and very strong but in some cases it is so lax and open that hernial protrusions take place through it, which are named from the seat of their occurrence. Sometimes too we have the great sacro sciatic notch not well filled by the muscles which occupy it and in this case portions of the bowel may be forced through this opening.

We have now finished so far as it is necessary for us the consideration of the pelvis and shall proceed at once to the bones of the upper extremity, these are divided into those of the shoulder, arm, forearm, and hand. The shoulder is formed of two bones

Clavicle

the scapula and Clavicle and has but one bony point of connexion with the trunk, namely at the sterno clavicular articulation, for although the scapula appears in all our preparations as being supported by the bones of the thorax, yet in the living condition there is two thick strong muscles between them. The existence of the Clavicle enables us to clasp our hands and arms together, in fact they are the parts concerned in all the prehensile movem-ents which we execute, forming the great difference

which exists between man and many animals.
All animals that climb, swim or fly, or use their fore extremities in the prehension of food, have this Clavicle, while others as the Ox, horse and even the elephant, with the great classes to which these belong, are destitute of it. The elephant supporting his whole weight by the great serratus muscles by which his body hangs between his fore extremities as in a sling. The Clavicle is properly so called as it is in reality the key bone of the upper extremities as it keeps the remainder of the bones of the shoulder & arm in their places to the trunk. It is articulated as you see with the upper bone of the sternum at its anterior extremity and with the acromion of the scapula at its posterior extremity. We find it long in proportion to its thickness and from this reason, together with its exposed condition and the readiness with which the force of falls upon the hand is transmitted to it makes it exceedingly liable to fracture. This generally occurs in its middle third where the bone is weakest and most superficial. It is round upon its upper surface except the posterior third which is gradually flattened down to articulate with the acromion. The anterior extremity is large and somewhat round and has a large surface for articulation with the sternum. This is intended to give freedom to its motions, an effect which is also greatly increased by the existence of an inter articular cartilage which makes as it were two joints for there is an entire synovial membrane upon each side of it. Here I show you this arrangement of interarticular cartilage and you may see what facilities it affords for extended motion of these parts; it acts in fact like the roller under the hammer of a gun lock, from the manner in which it is placed. This articulation is held together by an anterior and a posterior layer of fibrous tissue which meet upon the sides and form a perfect capsule to the joint. Near the sternal end of the bone you perceive a small tubercle and roughened ridge upon its under surface; this affords attachment to a strong ligament which from its shape is sometimes called the rhomboid, it connects the Clavicle to the first rib, forming the costo clavicular ~~attachment~~.

From this anterior articulation we find the bone curved forwards and outwards to afford space for the large vessels in their passage towards the axilla and head, after which it takes a direction backward and outward until within a short distance of the posterior articulation where it curves outwards and slightly forwards to its junction with the acromion, Upon the under surface of the bone you may see a small groove, which accomodates a little muscle, called the Sub-Clavicular, whose attachments are to this bone and the first rib, This muscle is of great importance apart from any action which it has, in the protection which it gives to the great vessels in case of fracture, for when this takes place and the fragments depressed, this acts as an interposed cushion preventing the fractured extremities from wounding the vessels, In the passage of this bone backwards you perceive that it passes over another portion or process of the scapula, called the coracoid to which it is attached by strong ligaments forming the Coraco Clavicular articulation, in description these ligaments are sometimes divided in two, the first which you see extended between the bones, is somewhat conical in shape and has therefore been called the Conoid; the external one which I now raise upon the probe, from its shape has been called the trapezoid ligament, They may however very well be described as one, for the division is devoid of practical advantages, The articulation with the acromion is also furnished with and interposed or interarticular cartilage to give freedom to the motions and is enclosed in a capsular ligament like the ~~anterior~~ internal one, This bone is marked by the insertion of several muscles which as they will have to be particularly noticed hereafter I shall now only mention, these are the trapezius, deltoid pectoralis, and sterno Cleido Mastoid muscles, We now take up for study the

## Scapula

Or shoulder blade as it is called in common parlance This belongs to the class of flat bones and occupies a space upon the posterior lateral part of the chest from the second to the seventh rib, serving as a

protection to the Chest as well as a support to the arm. When the arm hangs in the ordinary position by the side the posterior edge of this bone is nearly paralel with the spinal column, but from its great mobility it is capable of successively occupying a great variety of positions. It is concave upon its inner face for the accommodation of the subscapularis and a part of the serratus magnus muscle, and convex externaly, and these surfaces are respectively named the ventre and dorsum of the scapula. The general shape of this bone is triangular, the longest of whose sides looks backward and is called the base; the upper side is called the superior and the remaining one the inferior costa of the scapula. These three sides are of course bounded by three angles a superior ~~and~~ an inferior and an anterior angle, the last of which is no angle at all, on account of the glenoid cavity occupying this part; the lower part of this bone is very thin as it was not necessary to have great strength in this part, but rather extent of surface, the whole of which is occupied upon both sides by the large muscles which get their origin there. Upon the surface next to the thorax we see ridges running across the bone, forming it in to a number of shallow grooves, having the appearance of being produced by the ribs which in the ~~dead~~ bone they are in contact. These however are produced by the facisculi into which the subscapularis muscle is divided, by their actions making impressions upon the bone whilst in a forming state; these are sometimes seen upon the dorsum of the bone also. Running from the base to the anterior angle of this bone you perceive this elevated ridge, having an upward and forward direction; this is called the spine of the scapula, and divides the into two portions or fossa which are called the fossa supra and infra spinatus lodging muscles of the same name; at the anterior termination of this spine you see this projection or peak which is called the acromion process immediately below which we have the glenoid cavity for articulation with the humerus or arm bone; this process from its projecting and exposed situation is very liable to be fractured by blows or falls upon

the shoulder. This process has a roughened surface for the ligaments of the acromio Clavicular and ~~Coracoid~~ acromial Coracoid ligaments which you see upon this specimen. There is one more point to which I would call your attention at this lecture, namely the Coracoid process so called from its resemblance to a ravens beak. This projects forwards and upwards from the superior part of the scapula at its inner side, and is from half to three quarters of an inch long; this projects to the inside of the glenoid cavity giving rise to the Coraco brachialis and short head of the biceps muscles and also to the Pectoralis minor triangular ligament by which the head of the humerus is covered.

Lect. XIII.

There are some points upon the scapula remaining for consideration to day gentlemen to which I will now ask your attention. From its base which we have found to consist of the posterior side of the triangle we find arising the large muscle which in the many of the four footed animals constitute the sling in which their bodies rest. This we can readily understand by supposing them, instead of uniting on the middle line of the abdomen, to be one continuous band, attached at each end to the base of the scapula which supports the extremities. This muscle is the serratus major anti-cus. From this Costa of the scapula we have three other muscles arising, which go in a different direction; from the superior angle, the levator scapula and from the base lower down the rhomboideus major and minor. Upon the superior Costa we have this Coracoid notch which is converted into a foramen by this ligament which you see passing across. This foramen transmits the superior dorsal nerve, and sometimes the dorsal artery and vein, though they commonly take another direction. From near this notch, upon the superior Costa arises the Omo hyoid muscle which passes by a circuitous route to be noticed hereafter, to its insertion into the os hyoides. From this round edge of the inferior Costa arises the teres minor, except a small portion near to the glenoid cavity which is occupied by the origin of the long head of the Triceps extensor muscle of the forearm, and the inferior angle is

occupied by the origin of the teres major. At the anterior angle we find the glenoid cavity for the articulation of the head of the humerus. This cavity is shaped like the section of an egg shell, with the apex or point looking somewhat upwards, in other words it is an irregular oval, very superficial, being not more than two or three lines in depth, and yet intended to accommodate this large head of the humerus, no more than one third of which can at any time occupy the space. The pit is however deepened by what is termed the glenoid ligament, which appears as if formed by the dividing of the tendon of the long head of the biceps where it is inserted at the upper margin of the cavity. This seems I say, to split, one half running each way around the cavity and meeting at the bottom. By this arrangement the cavity is deepened so that the sine of a chord subtending it will measure more than a quarter of an inch. This cavity is somewhat deeper in the young subject than in the full adult as may be seen by the specimen upon the table. Into this shallow cavity we have the head of the humerus received, or rather the head is applied against it, and by the execution of the various motions of the arm each successive part may be brought to occupy the space. This head is confined in its place by a loose capsular ligament and by the tendons of the muscles which surround it. From the circumstances which we have considered with relation to this joint it must be very much exposed to dislocation. This frequently does happen, but the obstacles to its occurrence in some directions, very much reduces the frequency with which it would otherwise take place. For instance a dislocation upwards is impossible without a fracture of the acromion process, for this so completely overhangs the head as render this occurrence very improbable. It is obstructed upwards and forwards by the triangular coraco acromial ligament and by the coracoid process, which likewise cover it like a roof and effectually protect it. By this specimen you can well see the nature of these preventives. Upon the anterior side however it is much less protected, and this is the direction which dislocations of this joint most frequently take; out before the coracoid process

to lodge under the clavicle. The capsular ligament of this articulation we shall not study until we have gone through with the description of the arm bone or

## Humerus.

This bone is of various lengths in different subjects not so much however from difference of stature as from other inappreciable causes, as it sometimes appears to be hereditary. The length in a perfectly formed and well developed subject should be the same with that of the bones of the forearm, In the negro however the latter are generally the longest, and in the ape tribes, their superior length is considerable; in the long armed ape for instance, the great part of the length appears to be in the increased length of the forearm, the true arm being only slightly increased over other species. This bone is divided into body, shaft, or diaphyses, and extremities or epiphyses, Between these in the young subject is placed that layer of Cartilage by which the bone is admitted to extend its length, and it is not only to the long bones, or to the articular facets of bones that this arrangement takes place, on the contrary it is found to obtain in a great variety of other cases, for instance in this small scapula you see that the same kind of intervention occurs at the base of the acromion and coracoid processes, even after the spine has become entirely ossified, and this fact here may be of some importance, for in amputation at this joint of a child say 9. 10. or 11 years old, you need not turn your knife in such a way as to avoid these processes but on the contrary divide them through at their base, this would not be found difficult as I have often been consulted in instance where children have had the coracoid process pressed off. First then you see the semispherical shape of the head of the bone which articulates with the glenoid cavity and see also the difference in the direction of its axis from the axis of the shaft, forming an obtuse angle with it, you then observe a slight fossa or depression just outside of the articulating surface which is called the anatomical neck of the bone, Now there is a difference between the anatomical neck and the surgical neck of the bone, and it consists in this; the anatomical neck consists of all that part which is inside the

capsular ligament independent of the articular surface, whilst the surgical neck is less defined, in the case of the humerus it extends from the outside of the capsule to these two ridges which you see upon the bone, one for the insertion of the pectoralis major, the other for the latissimus dorsi and teres major. Now these distinctions are of some importance not only in reading but in the prognosis of fracture; for in fracture of the anatomical neck, within the capsule, where the bone is not covered by periosteum you will very seldom get bony union, whereas in fractures of the surgical neck, little diff-iculty may be experienced in getting solidification of the fragments. The shaft of this bone is rounded in its upper third, after which it appears as though twisted and takes a triangular shape for the middle portion, whilst lower down it becomes flattened, which by some is consid-ered to be the effect of the action the biceps and brachialis internus on the front and the triceps muscle upon the back of the arm, but I am disposed to consider it rather the result of original conformation or intention. Upon the upper third of the bone between the two ridges before mentioned you have a groove, deepening as it ascends. This is called the bicipital groove from its being formed for the transmission of the tendon of the long head of the biceps muscle. This groove separates the prominence arou-nd the head of the bone into two, which are called the greater and lesser tuberosities; the anterior or lesser tuberosity is occupied wholly by the insertion of the subscapularis muscle, by which the arm is turned in-wards and drawn down. The posterior or greater tuber-osity is of three times the size, and has inserted upon it three muscles by as many facets; the upper or anterior one is occupied by the supra spinatus muscle which comes out under the acromion and over the joint; the mid-dle facet gives insertion to the infra spinatus, and into the remaining one the teres minor is inserted. As we proceed down the shaft, we perceive a roughened tub-erosity near the middle of the bone, which marks the insertion of the deltoides, a muscle which covers the shoulder and its muscles completely. Upon each side of this ridge two smooth surfaces exist, which are occup-ied by the origin of the brachialis internus muscle.

between which and the ~~outer~~ upper side of the bone is inserted the Coraco brachialis. Commencing at the upper part of the arm and descending in a somewhat spiral direction by which to get from the inside to the outside of the bone we have the musculo spiral groove, - a very superficial and hardly recognizable depression, which accommodates the nerve artery and vein of the same name. From the upper part, or middle of the arm you see running those two ridges to terminate in the Condyles; upon these are attached the inter muscular ligaments as well as some of the muscles of the forearm, particularly those for its extension which are attached to the external ridge. These Condyles are very improperly so called, as they are not condyles at all, but rather tuber~~cles~~ osities, or as the french call them epicondyle and epitrochlea, calling the external articular process a condyle and the internal one a trochlea. From these arise the lateral ligaments and muscles of the joint. The lower end of this bone when looked at in the direction of the axis of the shaft appears as though suddenly bent forward at its lower end, and upon this bent portion the articular faces are developed. Into the anterior and posterior surfaces of the lower end we see these two depressions called the sigmoid fossa; the larger posterior of which is for the reception of the olecranon process of the ulna in extension of the forearm, and the lesser or anterior is for the coronoid process of the same bone in the flexed position of the fore arm; between these concavities the bone is extremely thin almost diaphanous in some specimens. In the ordinary position of the arm at the side, the internal condyle touches the trunk forming the apex of an obtuse angle, the arm and forearm representing two of the sides. This bent condition affords great facilities in some of the motions of the arm, and should be particularly noticed with regard to injuries about these parts. The angle is formed by the bevelling off as it were of the condyles at the expense of the outer one, so that we see in taking the protuberances beneath the skin for the line of the articulation, which some practitioners do we should go far wrong, as this line is about an inch and a quarter below on the inside while it is only about three quarters of an inch below on

the other, This is very necessary to be remembered as in dislocation or amputation its neglect would lead to serious error; for instance if you were going to amputate and should take this for the line of articulation you would have your flaps far ~~too~~ short to cover the ends when you should discover your mistake. Upon these tuberosities are attached the lateral ligaments of this which is a hinge joint, This articulation although covered by only one cartilage forms two perfect joints one with each bone of the forearm, Upon the internal side we find a ridge then a depression and then another more slight elevation, these are all for articulation with the ulna the middle depression being to receive the ridge like the ass's back which we find upon the articular surface of the ulna, We have externally also another tuberculated process with depressions each side of it for the reception of the head of the ~~[illegible]~~ radius, Thus it will be seen that it is impossible to bring the arm perfectly straight in the natural state of the parts without doing violence to some of the ligaments which surround this joint, In dislocations and ~~[illegible]~~ fractures of the forearm, I have known surgeons endeavour to bring the arm straight whilst the natural condition of the parts are curved, I shall next direct your attention to the capsular ligament of the shoulder articulation, This is exceedingly loose indeed the most loose of any about the body. In this specimen where we have the ligament dissected out you perceive it is pierced with several holes, through one of which passes the subscapularis, the other the ~~[illegible]~~ supra spinatus, then the biceps; and infra spinatus, all of which aid in the composition of the capsule and are lined upon their inner surface by the synovial membrane, The tendon of the biceps in passing down the groove has the synovial membrane reflected over it like the finger of a glove so that in fact it is still upon the outside of the membrane, The wisdom of this arrangement is very apparent as in this position, which is so much exposed to accident, a cut across this part might wound this membrane and not only give egress to the fluids of the joint but also give ingress to the air which would result in an inflammation and effusion of lymph to the

occlusion of the joint, This might at first sight appear to be of small import, but when studied out, the benefit is at once seen, We see that the joint when freed from its muscles drops down and hangs loose from the Cavity but this is on account of the absence of the support which these afford to it, as in the natural condition they hold it up in apposition, keeping it close under the overhanging acromion process. When these muscles become paralyzed from any cause as sometimes occurs we have a condition of the joint approximating that which you see here when they have been dissected off. and under these circumstances, dislocations occur with great facility, It is under such circumstances that we have, notwithstanding the assertions of Mr Abernethy, subluxations taking place under the coracoid process, such as I show you now, when you see the bone is placed in a fixed or locked condition under that process. It is true this can only take place in paralysis or disease of the muscles, for whilst they continue in a normal condition their contractions will effectually prevent it, nevertheless I have often met with such dislocations and can therefore vouch for them, But what is a subluxation what do surgeons mean by it?. they mean those luxations or dislocations which occur without the rupture of the ligaments, There can be no such thing as a subluxation downwards, because there the ligament is much shorter than any where else, and will not permit the arm to be carried beyond a certain extent without a rupture of these ligaments, In these dislocations into the axilla by falls upon the hand when in an extended condition always tear up the ligament from its adhesion to the neck of the glenoid Cavity and then allow the head of the bone to slip through the rent, these are very frequent modes of dislocation perhaps as often occurring as any other, The bone is not however as some surgeons say protruded through a rent made lengthwise in the ligament, and then strangulated like a button in a button hole, by the contraction of the fibrous tissue around the neck of the bone; this is altogether an imaginary condition and is only spoken of

veil their ignorance after having tried in vain on account of want of skill, to reduce the dislocation. Around this articulation we have a great quantity of Cellular tissue, and above the joint some ligament-ous bands which surround it beneath the muscles, these are called the accessory ligaments and add considerably to the strength of the articulation, Dupuytren some time ago called the attention of the profession to the fact that after a reduction of a great many dislocations, the bone refused to back into its place exactly, leaving the extremity longer than the opposite one, This he could not account for, but merely mentioned the fact, Some of the french surgeons and particularly Malgaigne turning their attention to the fact discovered it to be owing to the infiltration and swelling of the mass of Cellular tissue under the triangular ligament, The indication in such cases is to bandage the arm and shoulder in a tight sling and by the pressure get rid of the swelling when the bone will again occupy its place, In the reduction of dislocations the condyles or tuberosities at the bend of the elbow are of great service in fixing the bands for counter extension, and a good surgeon will always place his bands here instead of placing them above and allowing them to slip down, but in doing this it is always necessary to use some compresses upon the sharp edges of the ridges leading down to them, otherwise you would have a great deal of contusion in the parts which would give rise to a great deal of trouble from the ulceration and sloughing which would be likely to follow. Now gentlemen we have finished the bones ligaments and muscles which compose the shoulder articulation one which from its frequent implication in accident or disease is of so much importance to you, and one which well merits your particular attention, when we meet again we shall proceed down ~~the~~ the forearm in our consideration of the bones of the superior extremities,

Lect. XIV.

We have to day to continue with the anatomy of the remaining bones and ligaments of the arm, and first to the two bones which constitute the fore arm. These as before noticed vary very much in various individuals, and upon their varying lengths in a great measure depends the difference in length in different arms. In the same manner we see that the great difference in stature of different individuals is mainly to be attributed to the corresponding bones in the lower extremities. Of the two bones which go to constitute the fore arm the Ulna, which we shall first take up, has been so called from having been used by the ancients as a measure, and the Radius which is its fellow, is so called from its round shape and the rolling motions which it exercises having been compared to the spoke of a wheel. Of these two the Ulna is somewhat the longest, projecting a little below the Radius at its lower end, and some distance above it at the upper. In figure they are somewhat analogous, each having a large and a small extremity, which are reversed in such a manner as to make one large end correspond to the other small end, or in other words they are complimentary to each other. In looking at the

## Ulna

then we find that at its upper extremity it is somewhat prismatic or triangular in its shape, becoming rounded as we descend; indeed if we describe it as a triangular bone we must say that almost the whole of the inner face of the triangle is of a rounded form for the accommodation of the muscles which cover it. Upon the outer side of the Ulna or that which is towards the Radius we have this long rough ridge which is occupied by the interosseous ligament which extends between these bones. Upon the same radial side, at the upper extremity of the bone we notice a notch in the bone; this is called the semilunar or great sigmoid notch for the articulation of the head of the radius. On the articular surface of the bone we notice several elevations and depressions, the large ridge on the

middle being a continuation from the coronoid to the olecranon process, fitting into a corresponding concavity in the pully like head of the humerus, all being covered by the same expansion of cartilage, Now why are these elevations and depressions here? Why not, as this is a hinge joint, have a simple plane surface upon each bone? It seems at first sight as though it would have been just as well, but in that case we could have had no rocking motion whatever in the joint, a motion which is very usefull and is felt in the hand, being wholly due to this latteral socket, made by this arrangement. The projecting peake in front of the joint has been called the coronoid, from its crowning and protecting the joint The large process upon the posterior part of the bone is called the olecranon, and fits into the greater sigmoid cavity in the humerus, This process not going far enough into this cavity is the reason why the back of the arm cannot be made quite straight so as to touch a plane surface at all points; thus you see we have two angles formed at this elbow joint, one, that just named, projecting backwards, and another, spoken of upon another occasion, projecting inwards; both of these it is necessary to remember, as they are to be taken into consideration in setting fractures and reducing dislocations of the parts, in neither of which should you ever endeavour to bring the bones into a perfectly straight line. The attention of the profession was first strongly directed to this point by Dr Dorsey a surgeon of our times, The olecranon is indented as it were, and roughened upon its posterior surface by the insertion of the powerful triceps extensor Cubiti which occupies the whole end of the process, anterior to which you may see a triangular flat surface, upon which we rest when the elbow is placed upon a table, and on the side there exists a small depression for the insertion of the anconeus muscle, to which however it is not necessary that I should call your attention to day, as it will come up when we are studying other parts. The coronoid process is also a very prominent one as you may see and forms a part of the ridge received between the pully like elevations upon the humerus. The presence of this process in front of the joint presents ~~an insuperable~~ barrier to dislocations of this bone

backwards, there being little possibility of its occurrence without a crumbling off of the edges, which however does sometimes occur, the coronoid process falling into the greater sigmoid cavity, whilst the olecranon projects upon the back of the arm. The lower extremity of the Ulna presents a rounded head for articulation with the ~~radius~~, very much like that of the radius above presents to the Ulna, and from it you see projecting this point which from its resembling somewhat a nail, has been called the styloid process, ~~from~~ to which ~~arise~~ is connected a muscle and some ligaments. In this as in all other bones the extremities are developed from ossific points distinct from the shaft, in other words the epiphyses are separated from the diaphyses by a layer of cartilage by which the bone is admitted to lengthen. The coronoid process is in children, very often found cartilaginous at its base, which of course will favour the occurrence of dislocations by allowing the bone to bend, and thus form an exception to the general rule that dislocation backward cannot take place without fracture. I do not mean to say that in every case the whole process must be broken off, but that the points must be crumbled off to a certain extent. We after noticing three foramen for the nutritious vessels, near the middle of the bone, may proceed to the consideration of the

## Radius

Whose body is more rounded in shape than that of the last bone, presenting upon its inner side a like rough ridge for the insertion of that strong interosseous ligament, which is so necessary for the attachment of muscles, at the same time that it does not interfere with the motions of one bone upon the other, tending always to preserve their relations. These muscles eighteen in number occupying the fore arm could not have found either space for ~~origin~~ or, accomodation without some such arrangement. The head of this bone is also developed as an epiphyses, and is round or orbicular in shape, with a dimple or superficial depression on the top. The side of this head is received into the sigmoid notch of the ulna, where a free articulation exists, to

allow of the rotations of this bone; and with the other depression the condyle of the humerus makes a kind of ball and socket joint, by which the arrangements its motions at this joint have every possible facility and extent. The neck of the bone is small and round, and between it and the body we have this rough prominence projecting upon its inner side. This is called the Tubercle of the radius, and upon it is inserted the that strong flexor muscle which with one other, serves to antagonize the triceps extensor which we found inserted upon the olecranon process. I allude to the biceps. Just opposite to this point, upon the ulna you have the insertion of the other flexor, - the brachialis internus and these two constitute the proper flexors of the ~~arm~~ fore arm. As we descend upon the body of the bone we find some superficial depressions or grooves made by the action of the muscles, and find also that it gradually enlarges in size, - compensating for a similar diminution in the ulna, - until we come to the lower head where the object of the enlargement is at once apparent, namely to give support and articulating surface to the bones of the wrist, which must necessarily be connected with this bone alone in order that they should rotate with it, which in fact is the whole object of this motion. Upon the outer side of this extremity, I say outer side because by that we understand the radial or thumb side of the arm, not because it is really the outer side, for in the ordinary position of the hand as you see mine is now, the thumb is actually turned inwards; but the older anatomists having in their descriptions always supposed the hand to be turned supine, or on its back, has lead to an adherence to this, for fear of making confusion. Upon the outer side of the end of the bone you see this projection corresponding with the one noticed upon the ulna, which is called the styloid process of the radius, and running along the upper margin of the end, in a transverse direction, a number of elevations, forming between them grooves, which accommodate the different tendons, being confined in their places by the anterior annular ligament of the joints. These tendons it would be useless for me now to particularize, as you would not be able to remember them until we come to speak of the muscles which they represent. We find upon placing the bones in their proper relations

that a line drawn from one styloid process to the other would include above it, between it and the ends of the bones a concavity of about a quarter of an inch in depth hence by observing this the points of articulation between the wrist and forearm may always be accurately determined, as these processes may always be felt with facility through the integuments, This is important in the operation of amputation at this joint, which is now much practiced in the injuries of the hand so frequent of occurrence in our factories and machine shops.- for you should always cut your flaps in a corresponding semicircular direction, and large enough to cover in fully the ends of the bone and also to allow for retraction. The Cartilage of this articulation is peculiar in that after covering the end of the radius, and the side articulation with the ulna continuously, it sends a plate like an interarticular cartilage to interpose between the end of the ulna and the bones of the wrist, whereby this ulna is entirely cut off from articulation immediately with any of these bones, We next take up for study the bones of the wrist which constitute the proper.

## Carpus.

These are 8 in number, are situated between the ends of the bones of the forearm and those of the fingers, forming that very movable joint so necessary to the perfect motions of the hand; here in this specimen you see them in their proper places, all together, where they may be divided into two rows, the upper four being called the antibrachial from their articulation with the arm, and the lower four the metacarpal row, These bones are named from their shapes and sizes, thus commencing from the radial side we have first this hollowed boat shaped one which is called the scaphoides, then a kind of semicircular one which is the os lunare, and again this one which from its wedge shape has been denominated the cuneiforme,- the small one on the outside which has no attachment to the first joint being called from its shape also the os pisiforme and this constitutes the first or upper row, the second is formed first beginning again at the radial

side, by this irregularly four sided bone the trapezium, second by this which although not four sided like the last, has some resemblance to a trapezium and is therefore called the trapezoid, thirdly by this which is always distinguishable from the rest by its superior size the os magnum, and lastly by the irregularly shaped one which is the unciform, and this projecting process which comes off from its body is the unciform process. Now I could waste a whole lecture in the description of these bones and their various modes of connexion, but I conceive that it would only be a waste, and I shall therefore confine myself to giving you what I consider a sufficient description, to a practical knowledge of the articulation. We have seen that the bones of the forearm present a concavity downwards, and into this as into a socket fits the head formed by the junction of the ~~four~~ three bones of the first row; you may see in this disjointed specimen that these do really form a head, the os pisiform however being merely affixed as it were to the others without contributing at all to the formation of the joint. This articulation is as you see, belongs exclusively to the radius there being no contact with the ulna at all. Now these four bones as will be seen when I bring them together, not only form upon their upper side, a convexity or head for reception into the corresponding concavity of the radius, but form also upon their lower surface two parts of the second joint, first a concavity similar to the one above, for the reception of another convexity or ball consisting of the os magnum and unciforme, this upon the ulnar side; - and upon the radial side you have the second part of this joint formed in the same way but in an opposite direction by the projection or ball made by the scaphoides of the first row, being received between the trapezium and trapezoides of the second row to form another ball and socket joint, so that you will perceive this line of articulation to be formed by two ball and socket joints, as it were, - the ball of the one being formed by one row and the other by the next row, or in other words projecting into their respective cavities in opposite directions. This is then a very perfect articulation and offers almost insurmountable barriers to dislocation, at the same time that it affords every facility for motion in the different directions

This beautiful arrangement of the lines of articulation should not be forgotten; and when remembered perfectly, will enable you to cut into the articulation with certainty, even though the particular arrangement of the different bones may have escaped the memory, and without which knowledge no operation should ever be undertaken. This of which we have been speaking is called the middle carpal joint, and is the one in which the two lower joints most motion is executed. The lower margin of this last row, is as you see, articulated with the metacarpal bones of the thumb and fingers, which are articulated as follows. The trapezium receives the entire articulation of the thumb, and a part of that for the first finger which is completed by the trapezoides; the os magnum forms almost the exclusive base for the middle finger, and upon the unciform, those of the ring and little finger are received. This line of articulation is a portion of the anatomy of the hand which should be carefully studied, as without a complete knowledge of it the operation now so often resorted to, of amputation at the metacarpo carpal joint, could not be undertaken with a chance of success. This joint may always be found superficially by feeling for the projecting ridge upon the back of the hand and is seen to form a semicircular line there, which however, when we inspect the bones is found to be somewhat irregular, for the first metacarpal bone being longer than the rest is received into a notch in the carpal bones. Now to operate properly the knife must, by particular management, be carried round this projection of the bone, and after that the line is followed without difficulty. You should then first introduce your knife upon the radial side, cutting at first in the oblique direction of the head of the last metacarpal bone gradually bringing it down until you come to the end of the first metacarpal bone, when knowing the fact that it is interlocked between the bones, you by a see saw motion of your narrow bladed knife follow the direction of the articulation until you get entirely around it when the line

f finger

becomes regular and you have no more trouble. Anatomists generally describe five metacarpal bones and three phalanges to each finger with only two to the thumb; but some on account of the motion exercised by the first bone of the thumb, regard it as a phalange, and therefore in their descriptions make only four metacarpal bones and three phalanges to both fingers and thumb. This is a matter of no importance being rather a ~~mad~~ subject of fancy than otherwise. These metacarpal bones present ~~two~~ their heads developed in the usual way, are smooth and round presenting a concavity towards the palmar surface and a convexity in the opposite direction. That of the forefinger as before observed is rather longer than the rest projecting at its lower extremity. These bones are somewhat flattened upon their sides by the action of the inter~~costal~~ osseous muscles, are irregularly formed at the upper ends where they articulate with each other at the sides, as well as with the bones of the wrist at their ends; they are not quite but nearly immovable with the exception of that of the thumb, which is very movable, having a peculiar articulation for this purpose. At their lower ends they have complete condyles, by which we mean rounded extremities whose extent is greater transversely to the line of motion, - and these condyles are received into shallow glenoid cavities upon the ~~lower~~ upper ends of the phalanges. The smooth articular faces of these condyles extend further down in front than upon the back, for the purpose of allowing the fingers to be flexed until the bones come nearly into contact, whilst in extension they cannot go much beyond the straight line. Upon each side of their condyles we have a depression for the lodgment of the strong lateral ligaments of the joints. The metacarpal bone of the thumb is much thicker and stronger than that of the fingers and has a kind of concavo convex articulation with the trapezium by which its different directions of motion are executed, in other respects it is similar to those already described. The phalanges of the fingers are found to be round upon their backs and flat or concave upon the palmar surface to admit of the strong flexor tendons, and where these round and flat surfaces meet upon the sides you have a ridge for the attachment of the theca of the

~~te~~tendons. They present glenoid cavities upon the upper ends and condyles upon the lower. The second phalanges correspond so nearly with the first, that with the exception of being shorter and smaller, the same description will apply to them; the third however are very different; they have the same arrangement of glenoid cavities at their upper ends, but at the lower they present an expansion, -a kind of exostosis flattened transversely, which are for the support of that bed of papilla wherein resides the sense of touch to a greater extent than in any other part of the body, and which consists in an erectile tissue which to be exercised ~~wi~~with the greatest nicety must be lightly pressed, as we are from experience aware that hard pressure destroys in a ~~great~~ measure the delicacy of the sense.
My hour ~~has~~ not quite expired, gentlemen, but in as much as little of it yet remains, and I am sure you must all be hungry I shall postpone the consideration of the ligaments until I meet you again, and I would just remark ~~that~~ for the future as we all get very hungry as 2 o'clock approaches, it is but fair that we should all wait and get a fair start together.

Lect. XV.

I wish to day gentlemen to call your attention to the remaining ligaments of the superior extremity, and first to those of the elbow-joint. This as you know is a hinge joint, and there was therefore, as in all instances of this kind of joints, necessity only for very strong lateral ligaments without an entire strong capsule. We have accordingly, upon the internal side the Brachio ulnar ligament arising from the internal condyle and dividing into two portions, the anterior to be inserted upon the base of the coronoid and the posterior upon the olecranon process; the one being put upon the stretch during flexion the other in extension of the forearm.
We have also an external lateral ligament, arising from the external condyle and inserted into that which surrounds the neck of the radius. These constitute the strong lateral stays of the joints whilst the various tendons and muscles give the adequate protection to the front and back parts. There are also, as is exhibited by this specimen other ligamentous fibres coming off in thin bands from the anterior surface of

the humerus to be inserted below, which are lined by the synovial membrane and give a Capsular appearance to the investment; these are called the accessory ligaments of the joint and their continuation invests as well the sigmoid cavities giving to them also a synovial membrane. Now the radius rotates here as a separate bone, moving upon its axis as well as forwards and backwards, and has therefore necessity for a particular ligament to confine it in its position, This is called the orbicular ligament and arises from one extremity of the sigmoid notch in the ulna, to be after encircling the neck of the radius, inserted into the opposite extremity, Into this are inserted the Capsular and external lateral ligaments which prevent its slipping down from its place. This as you may see by the specimen before you is not very strong, and is liable to be ruptured sometimes from slight causes particu-larly in Children, Cases of which I have been very often called upon to treat, We next notice that the Cartilage with which the ulna is tipped extends continuously over the sigmoid notch for the radius as well as over that part of the bone which is articulated with the humerus Next we have the oblique ligament, which from an origin upon the inner side of the joint upon the ulnar runs obliquely downwards to be inserted upon the radius just below its tubercle, This ligament is evidently intended to limit the rotation of the radius outwards, as we see that after turning the hand supine to a certain extent we find a check to farther motion in that direction which check is given by this ligament, Some distance below the tubercle of the radius we have extending across in an oblique direction a series of ligamentous fibres constituting the interosseus ligament before mentioned, These fibres do not all run in the same direction, but exhibit an evident decussation, We now have to consider the articulation at the lower end of these bones, and first observe the peculiar arrangement of the cartilage covering the end of the radius; after extending over the lower end of the bone, we see it sends a process up upon the side for its articulation with the ulna and also sends, as I show you here a triangular plate whose point is attached to the styloid process of the ulna where by all interference of that bone in the wrist joint is entirely cut off. There exists between this triangular

plate and the end of the ulna a very loose synovial membrane, which from this condition is called the sacci-form membrane, This ulna on account of this peculiar arrangement, may be detached without at all interfering with the wrist joint, and is often dislocated forming a prominent projection upon the side or back of the forearm a prominence which from ill treatment is often met with long after the accident, with only the inconvenience arising from the deformity, When cut into as I am now about to do, you see the entire independence of this articulation of the common joint a point which it is of some importance to remember In considering the ligaments of the wrist joint we are aware that quite a number must be necessary in the binding together such a complicated joint, the object of which seems to be to afford free motions at the same time that unsightly angles are avoided, Between the separate bones of the carpus we have a great many small ligaments by which they are connected with one another in the rows of the articulation, upon the inside arising from the styloid process of the ulna ~~and~~ being inserted into the pisi-form and cuneiform bones you have the internal lat-eral ligament, and upon the outside inserted into the scaphoides and trapezium you have a corresponding one The ligaments upon the anterior and posterior surfaces although well defined upon these specimens, it will be difficult to make obvious to those of you who sit at a distance, I shall therefore have recourse to these magnified representations for the purpose of making the demonstration more satisfactory, You may however first perceive upon the specimen how these separate rows or joints are kept distinct by these interosseous ~~membranes~~ ligaments, Here upon the back you perceive a kind of capsular ligament made up of a great number of fibres intersecting each other in vari-directions, these are distinct ligaments and are called the dorsal, that a number of which exist, is all that it is necessary to recollect, the detail being of no importance, Upon the opposite or anterior surface again we have a number of other fasciculi constituting the palmar ligaments, Now by a careful examination and dissection all these dorsal and palmar

ligaments may be exhibited and described, but this is by no means worth while as the may be shown quite clearly upon these enlarged representations, We then first notice notice the ligaments which unite the bones of the forearm or the radio ulnar ligaments, secondly those between these bones and the first row of the carpus which are considerable in number crossing in various directions to protect and confine the joints in their position,
In addition to these we have transverse bands running across at the upper ends of the metacarpal bones, making altogether a general capsular investment to the joints of great strength, We have these transverse ligaments not only at the upper ends of the metacarpal bones but also at their phalangial extremities whereby they are held strongly together, The thumb joint with the metacarpal bone, has an entire capsule, together with lateral ligaments whose strength is greater than would be supposed without examination, the one which I raise up for instance being nearly as thick as an ordinary goose quill, These ligaments should be carefully observed with regard to the operation which I mentioned yesterday, in as much as unless they are properly cut you would not be able to effect your purpose as no strength could break or tear them We next come to the articulations of the fingers, and here we have no proper capsular ligament, for if you strip up the tendons as you see, the joint is at once exposed; the lateral ligaments here however are very strong as in all hinge joints the tendons passing in front and behind being lined by synovial membrane serve the purposes of ligaments in strengthening and protecting the joints, The lateral ligaments of the thumb joint are very strong and in dislocations are very rarely ruptured the bones rather slipping over and becoming locked as it were, These dislocations it is often found impossible to reduce, and it was for this purpose that sir Charles Bell some 20 years ago recommended the insertion of an iris knife obliquely under the skin and dividing one of these ligaments to admit of the bone being replaced, It is therefore to him instead of Dieffenbach or Stromeyer that we in fact owe the origin of tenotomy for this was nothing else than that operation as it is now practised with so much success,
Upon the front portion of the joints of the fingers we

find a ligamentous or cartilaginous thickening, which acts by throwing the tendon somewhat out of the direct line of motion, like a pulley, thereby increasing much the effect of the muscular contractions. The extensor tendon is spread out over the backs of the joints so as to form a portion of a capsule being lined by the synovial membrane. This will apply to all the phalanges of the fingers the joints of which are arranged in precisely the same manner. Upon the edges at the sides of the phalanges, which unite the round and flat surfaces of the bones, we have inserted the vaginal ligaments as they are called from forming a sheath for the tendons to plug 'em; these are sometimes also called crucial ligaments from the fact that their fibres cross each other in different directions. These keep the tendons applied in their places enabling them to act to a much greater extent than if they were loose or unconfined. When I draw them out as you see, they are still found adherent by some ligamentous bands at different points which also serve to keep them in their places. These thecæ or sheaths are lined for their whole length by synovial membrane and also contain some cellular tissue a swelling of which continuing to a great extent, from puncture or other cause of inflammation of the synovial membrane, - in this strong sheath constitutes whitlow or fellon. This swelling after having become greater and greater, successively involves the tendon, periosteum and bone producing caries which constitutes true whitlow, this is, if left alone finally separated by sloughing and the patient gets well with his finger contracted by the cicatrization of the wound. Now the best practice in these cases is to take your bistoury insert it below the affection and lay the whole vaginal ligament freely open, thereby removing the pressure and giving passage to the discharges whereby the healing of the wound is ~~precipitated~~ facilitated. I may remark here that it is commonly said that the synovial membrane covers the ends of the bones, and is therefore a continuous membrane throughout the whole of the wrist joint, and this is the avowed reason why some surgeons hesitate to cut into this joint, saying that the inflammation of this membrane

will extend to involve the remaining portion of the joint. This description I think has now been sufficiently minute to be of practical importance, and we may now therefore go on the study of the lower extremities and first of these to the

## Femur.

Or thigh bone, of which I here show you two extraordinary specimens, These were taken from a negro who from his enormous hight and size received whilst alive the cognomen of the angel Gabriel the later being his surname; he had a shuffling gait and was found after death to have been taller upon one side than the other for as you may see one bone is somewhat longer than the other, This bone like many of the others which we have studied is developed in a shaft and epiphyses, The shaft is always somewhat curved, presenting a convexity forwards, which is much augmented in some conditions of disease, as for instance in the Rachitis of Children when the bones become softened and yielding, the pressure of the incumbent body gives to them a curve beyond the natural one, which often remains as a deformity during life, Upon the upper part of the shaft we have developed two prominences one upon the outside the other upon the inner side which are called the trochanters, these grow as epiphyses upon the bone and are intended for the insertion of muscles The outer one is the greater of the two being called the trochanter major, from their use which is to turn the limb; this projects up to within half an inch of the highth of the head of the bone, is curved inwards overhanging a notch which from its shape appearing as though made by the finger, is sometimes called the digital fossa, This it is important to understand in as much as in the operation at this joint the knife has to be curved around in this fossa in cutting down the flap, Upon this trochanter at the top is to be seen three surfaces, upon the anterior one of which is inserted the gluteus minimus, upon the superior smooth one the gluteus medius and over the remaining one the tendon of the maximus seems to its insertion upon a line which you see running down below

the trochanter in the digital fossa or depression at its root are inserted all ~~the~~ but one of the muscles which serve to turn the limb outwards, and passing from the base downwards and backwards you perceive a rough ridge for the insertion of the quadratus femoris muscle the particular situations of any of which it is not necessary now to give you in as much as I shall have to call your attention to them further on in our course. Upon the internal side of the bone a little below the great trochanter, we have a more conical prominence the lesser trochanter upon which is inserted the lower part of the conjoined tendons of the two great flexor muscles of the thigh namely the Psoas magnus and Iliacus internus. The neck of the bone is not continuous in direction with the body of the bone, but stands off from it at an open angle whose direction being inwards forward tends largely to separate the shafts of the bone at the upper ends. This angle varies very much in the different sexes as also at different periods of life, In the female for instance the angle is not so large, setting therefore the upper part of the thighs wider apart than in the male, Many persons argue, and perhaps with some reason that this difference in the angle makes by shortening the bone, part of the great difference in stature which exists between the sexes, In old age of both sexes the angle is commonly found to be considerably reduced, giving greater squareness to the hips, and accounting fully for the decrease in stature observed in increased age.- Rickets will also exert a great influence in this particular, where the bones become so softened as to be unable to resist the modification produced by the weight of the body pressing upon them, - as well as an alteration of the angle, the neck of the bone under some of these circumstances appears actually to become shorter and therefore affect the stature in another way, Indeed of all the parts of the whole osseous system, this appears to be the most liable to changes and variations seldom finding two subjects in perfect correspondence, The neck of the bone is much smaller than the head, offering in that respect a great difference from the humerus; the difference in the

circumference between the head and neck being about two inches. The head of this bone presents the greater part of a sphere, and forms a part of one of the most perfect joints in the body, It is covered by cartilage and has upon its top a depression for the insertion of the round ligament of the joint which extends from this point to the bottom of the acetabulum or cavity for the reception of the head. This head is received into the cavity of the joint in an oblique direction, which obliquity is rendered greater by the inclination of the bones at the knees, occurring in consequence of affording a more firm support. As we pass down upon the body of the bone we are struck by the rough ridge which presents itself upon the inside or posterior surface of the bone and is called from its roughness the linea aspera, upon which is inserted all the strong muscles of the parts, The upper end of this line may often be traced into three distinct lines one running upon each side of the trochanter and sometimes a third to the commencement of the digital fossa, at the lower end of the bone it divides into two lines one of which goes to each condyle leaving a flat space between them, This line seems to be developed as an apophyses upon the bone, now the difference between an apophysis and an epiphysis whose etymology is precisely the same, is defined to be that the latter is developed from a distinct point of ossification whilst the first grows from the bone, This line and its analogues, seem as though they might have been formed by the action of the muscles whilst the bones were yet in a soft and mouldable condition, as we know that contractions of these muscles do take place whilst the child is in utero, Into this ridge we observe running two or three foramina for the transmission of the nutritious arteries of the bone; The capsular ligament of this articulation is one of the most perfect, and the strongest in the body, covering the whole head and a part of the neck which it strangulates as it were, the parts within this capsule having no periosteum as always happens when bone is covered by synovial membrane, are not when broken, likely to be united by bony deposits

Lect. XVI. Having shown the bony structure which constitutes the hip joint, I have to day to call your attention to the ligaments which connect them. We have before noticed the existence of a cavity, formed by the junction of the three bones which make up the os innominata, - for the reception of the head of the os femoris or thigh bone. This is called the cotyloid cavity or more scientifically the acetabulum, from its cup like form. The upper and anterior part of this cavity is of a much greater depth than any other portion, overhanging as it were the head of the bone, the necessity of which arrangement may be at once seen, for if it were otherwise the ~~whole~~ weight of the whole body which comes upon this point could not be so well supported as by the firm bone. The lower margin of the acetabulum is not so deep, and there exists as you see in the lower anterior part this notch, which gives the appearance of some portion of the rim having been removed. This breach is intended to give entrance to the branch of the obturator artery and its accompanying veins and nerves by ~~which~~ which the joint is supplied being filled up with the fibrous tissue which surrounds the cavity. There also exists another breach of less extent in the anterior upper part of the margin which is only filled by the before mentioned elastic tissue. These two openings as might be supposed, offer facilities for dislocations at these points, first by the greater notch into the foramen ovale, and by the second one the head of the bone is admitted above the pubic bone, constituting the supubic dislocation. The diminished elevation of the posterior margin also gives occasion to the displacement upon the dorsum of the ilium. I next call your attention to the particular arrangement by which this cavity is deepened. This occurs by means of a ligamentous structure of a triangular form by which the edge of the cup is surmounted, being firmly fixed by its base to the bone. This is about a quarter of an inch in depth and of course deepens the cavity to that extent besides filling all the irregularities around the margin of the acetabulum. This cotyloid ligament adheres very firmly by its margin to the capsular ligament of the joint which thereby supported. By this arrangement the head of the bone is closely invested and as you see holds ~~the~~ it in its place by a kind of suction, performing the part of a valve, from which it requires some force as you see, to withdraw it

from its socket, At the bottom of the cavity we find a quantity of fatty matter covered and confined by a cover-ing of synovial membrane, - a swelling of which, produced by the synovial inflammation is said and taught by many surgeons of our and past times, to be the occasion of the lengthening of the limb in the first stages of Coxalgia, It is, however, not proved, and as I think not probable, because in the first place it is not by any means proved that a leng-thening does really take place, - that which is apparent being most probably due to the depression of that side of the pelvis from the opposite one having to support all the weight. This depression which takes place to a considerable extent in the ordinary motions of the body in throwing the centre of gravity from one side to the other, doubtless becomes increased under the circumstances of disease of one of the joints and may well give rise to a deceptive appearance of lengthening, besides it is hard to conceive that this head which fits so accura-tely and requires so much strength to detach it when the natural connexions have been divided, may be ultimately forced from its socket by the infiltration of the cellular tissue behind it, The only means by which we can judge of the length of a limb is by measuring from the anterior inferior spinous process of the ilium to the internal malleolus and this is only approximate, as we can never come within a quarter of an inch, however much care we may use We next have to examine the Capsular ligament of this artic-ulation, This we find to be not only the strongest but the most perfect capsule in the body, It has its origin from all the neighbouring portions of bone, ilium ischium and pubis, by strong and dense ligamentous fibres, which are collected around the joint so as entirely to hide from view not only the immediate joint, but a considerable portion of the contiguous bones, being inserted upon the rough lines before pointed out, which pass between the greater and lesser trochanters, both anteriorly and posteriorly, We have coming from the anterior inferior spinous process as you may see, a band of additional fibres, which is called the accessory ligament, also another from the side of the foramen ovale, both of which are intended to stren-gthen the capsule at the parts where most strength is required, When I open this ligament you will observe that its thickness must necessarily give it great strength

particularly upon the upper and anterior parts, at the lower and back parts however, where little strain is ordinarily put upon it, it is much thinner, This thinning below is also necessary to afford more room for the free motions, and it is here that in strong and forcible abduction of the limb is very liable to produce a laceration which allows the head to slip out and constitute a dislocation downwards which [illegible] from this fact is perhaps not the most common direction, It will be seen that the insertion of this ligament occupies a considerable extent of bone, covering it half an inch lower down on the anterior than on the posterior part, Now we know that fractures taking place within the capsule, rarely, perhaps never unite by bony structure from the fact that they are not covered by the vascular periostium whose office it appears to be to secrete the bony matter, - deriving in this instance, the nutrition or circulation only from the branches of the obturator artery which pass through the ligamentum teres to supply scantily the head of the bone, The absence of blood vessels may entirely suffice to explain this deviation from what takes place in other parts, And we may naturally attribute, I think, those cases in which bony union is said to have succeeded to fractures within the ligament, to the fact that from the capsule decending half an inch lower upon one side than the other, a fracture might readily occur which should be within the capsule anteriorly, whilst opposite, it would be outside and in a portion of the bone with the ordinary investment of periostium by which the injury would be repaired, In addition to these points we have to examine what is called the ligamentum teres or rotundum, This I think is somewhat erroneously termed as it is not round but rather triangular in shape and runs from the pit or depression which we have seen upon the head of the bone, apparently to be inserted into the mass of fatty matter which we find lodged at the bottom of the acetabular cavity, but where it is in fact only fastened down by a reflection of synovial membrane which covers the whole ligament like the finger of a glove, serving by its attachments to fasten down this mass of adipose substance which Havers, conceived to be engaged in the secretion of the synovia, and which him

Lig teres

been called the glands of Havers, but which are now known to be only as cushions whereby to prevent shocks from sudden concussion. This ligamentum teres is therefore not inserted into the bottom of the cavity, but divides there and has its insertion one part into each extremity of the greater notch in the margin of the acetabulum, where it is connected with the cotyloid ligament, as may be seen when the round ligament is put upon the stretch. The use of this appears to be not to prevent adduction of the limb, but to place a check upon the strong abduction. I remember some time ago to have been called with my friend Prof. Horner to a case in which a gentleman, ~~a tailor~~ of this City had perceived whilst going along the street, a child in great danger of being run over by some horses. He reached over very far to catch the child, after which in endeavouring to regain his position, he experienced a most excruciating pain in this joint. No evidences whatever of dislocation could be perceived, and he was bled and blistered and leached without any effect upon the severe pain which he suffered. Conceiving that his sudden movement might with his position, have torn loose this bed of fat from its attachment, and placed it so as to be pinched between the bones, I with a sudden motion gave his leg a turn at the same time extending it slightly, whereby, on letting it slip back, he was entirely relieved from pain and speedily recovered the use of his limb again. In this case I have no doubt that the pinched tissue was the cause of all the difficulty and that by the extension and rotation this was restored to its place again giving to the patient instant relief. Now here you see it is of importance to understand the exact condition and construction of these parts in order to give the proper direction to your exertions to remedy any of their derangements. We at our last meeting had proceeded with the study of the os femoris down as low as the condyles, which must now claim our attention. We notice at the lower end of the bone, a gradual expansion by which the bone is much increased laterally being formed into two condyles an internal and an external; of these the internal one is much the longest and when the bone is held in a vertical direction projects greatly below the external one. Between these condyles posteriorly there is as you see a great notch, perfectly separating them

from each other. This notch is for the accommodation and protection of the popliteal vessels and nerves which enter the leg at this point; there is also a more superficial one upon the anterior and lower part for the play of the patella in the flexion of the leg upon the thigh. This anterior one is formed principally upon the external condyle where the tendon has a greater tendency to slip out of place. In the natural position of the limb, by which that grace and contour of frame is attained, the body of the bone occupies an oblique direction inwards in such a manner that the knees approaching very near together bring these apparently dissimilar condyles upon a level with each other. This obliquity when occurring to an unnatural extent produces that deformity known as knock knee. In wide pelves where the inclination does not take place to the ordinary extent, there is a rolling motion produced in the gait. This is characteristic of the female and is always the result of her wider pelvis throwing her lower extremities further apart, and the same condition to an extraordinary degree produces that waddling pace in the common duck. These are the qualifications necessary to the function of reproduction which she has to perform. We find upon the side of each of these condyles a depression, roughened at the bottom, by which the strong lateral ligaments of this which is a hinge joint and therefore supported at the sides, are attached. Upon the internal side of each condyle we have upon the one a tubercle and upon the other a depression for the attachment of the crucial ligaments of which we shall have to speak hereafter. Upon the internal condyle we have a tubercle as you see, upon which is inserted the tendon of the adductor magnus ~~semi membranosus~~ muscle, which gracilis acts upon this bone as a flexor. We next take up for consideration the bones of the leg, which are two in number and bear some analogy to those of the fore arm in their relative position and manner of arrangement, although not articulated for motion in the same way, being almost entirely fixed in their relations one with the other. The first of these which will occupy our attention is the ~~t~~

# Tibia

Which has been so called from a resemblance to an

ancient musical instrument of a like triangular shape This bone is in general conformation triangular with two heads, the upper of which is very broad and large, being gradually decreased towards the body of the bone, It has a broad horizontal surface for articulation with the femur, which having two condyles, is accommodated with two shallow cavities, which from their shape may be called glenoid, and these constitute exclusively the whole knee joint, the fibula not entering at all into the articulation, The cavity for the internal condyle is rather the longest and deepest, to accommodate the superior length of that bone; that for the external one being nearly circular Between these two we find a ridge rising into the joint, which is called the spine of the tibia, upon either side of which are inserted, the one anteriorly, the other posteriorly, the crucial ligaments, The semilunar cartilages, an arrangement by which these cavities are considerably deepened are also attached to this ridge, These consist in cartilaginous rings, thick upon their outer edges but gradually thinned as they approach the centre, being unconnected with the bones except by their ends to these ridges, These very much facilitate the motions of the joint as well as decrease the friction, being included in the synovial membrane and lubricated by this fluid, We next notice upon the front part of the tibia a short distance below the articular face, a roughened elevation called its tubercle upon which is inserted the strong ligamentum patella, Above this tubercle the bone is bevelled off to the face of the articulation, by which it is intended to accommodate the ligament and patella in the flexed position of the limb, preventing the standing out of this bone and tendon, and allowing flexion to take place to a greater extent than if the tendon had to be bent over a projecting angle upon this bone, From the lower edge of this tubercle we have running downwards a sharp cutting edge in shape like the italic S, This is called the crest of the tibia and is in the natural condition only covered by the skin, facia and subcutaneous tissue, This is the reason why in blows and contusions of the shin which this part constitutes in common language give rise to so much pain, The particular direction of this curved line it is important that you should not forget, as it is the guide by which you set your fractures of this bone, It is therefore necessary to recollect

in tracing down the line of the crest, that it should incline outwards at the upper part and inwards at the lower, and an endeavour to render it perfectly straight would probably result in deformity. The inner anterior face of this bone is smooth and covered only by the integuments and superficial vessels, The outer surface is irregularly grooved by the action of the tibialis anticus ~~Ext~~ extensor longus digitorum pedis and extensor proprius pollicis muscles which occupy its face having their origins from some part of its head or body; this surface is bounded posteriorly by a sharp ridge running nearly the whole length of the bone, upon which the strong interosseous ligament is inserted, The posterior surface is rounded and covered by the tibialis posticus; gastrocnemius and soleus muscles, which I believe have had the effect, whilst the bone was in a soft mouldable condition as in the foetal existence, - of rounding the edges and bringing it to a state to accommodate their motions, About $3\frac{1}{2}$ inches from its lower end we have the smallest part of the bone, the situation of all others where fracture is most liable to occur, and where it does occur in the majority of the cases which come under notice, The lower head is of a somewhat square shape the internal side being prolonged to form the internal malleolus, - beneath you have the surface for articulation with the astragalus, the whole of which is lined by a single expansion of cartilage over the bone, Upon this internal malleolus is inserted one of the strong lateral ligaments of the joint, the other extremity being continued downwards to the bones of the foot. We now come to the consideration of the

## Fibula

which constitutes the remaining bone of the leg, This bone is irregularly triangular in its shape presenting a rugged exterior, caused by the origins of the muscles which occupy it, It has two heads or epiphyses by one of which it is articulated with a smooth facet upon the outer posterior part of the head of the tibia being entirely independent of the joint, and by the lower is attached to the tibia in a slight depression existing on the outside of the lower head of that bone, This does not form an articulation or joint although

some cartilage is interposed between the two, the bones are rather held firmly together by means of the strong triangular ligament which joins them, We may here notice another fact that is of much importance in the operations of amputation upon the leg, in cutting the flaps of proper proportion; that is that the fibula although much posterior to the tibia in front, is on account of its much smaller size; upon a level with the back part, the bow-shape of the smaller bone giving to it a slight projection in the middle, The inner edge of the triangle of the fibula is for the insertion of the interosseous ligament, and the numerous roughened spaces give evidence of the insertion of the muscles upon it, Near its head you have a tubercle for the external hamstring muscles and the lateral ligament of the joint and at the lower end we have its extension into the external malleolus which is longer and more posterior than the inner one, giving to the foot a natural outward turn,

Now we have between these bones and the thigh the

Patella

which is shaped something like the horse chesnut, or the prostate gland, presenting a point at one extremity and a thickened portion for the insertion of the strong ~~ligament~~ tendon muscles at the other; upon the outer surface you see a great number of foramina some of which are for vessels, but a great many serve to give attachment for the ligamentous fibres by which it is surrounded, This seems to be developed as a sesamoid bone, in the centre of the great ligament or tendon of the quadriceps femoris, Its inner surface presents two articular facets divided by a ridge in the middle, of which the outer is the larger, This ridge is strictly accommodated to the notch between the condyles, always maintaining the same position with relation to the tibia from its tendinous attachment. From the depth of the anterior notch this bone cannot be dislocated in the flexed position, but under contrary circumstance from falls or blows; it may be dislocated outwards, which direction depends upon the angle formed at the knee and the tendency of the muscles to act in a straight line, This occurrence requires to for its production a relaxed condition of the ligaments such as we find for instance in opera dancers &c The treatment of this accident when occurring should be by flexing the thigh upon the pelvis, and keeping the leg extended, when it may be easily replaced.

Lect. XVII.

I have to day gentlemen to call your attention first to that very important, but perhaps to you not very interesting study, the structure and arrangement of the knee joint. You will remember that I yesterday directed your notice to the patella and some of its connexions, when we saw that it was developed as it were in the tendon of the quadriceps extensor muscle, - that it was about 3½ inches above the lower end or insertion; - we saw also (what is not generally noticed) that this tendon and patella had broad ligamentous expansions attached upon each side, which would tend strongly to prevent dislocations in any direction. We now perceive that this knee joint has no proper investing capsule; but that in common with all hinge joints which it represents par excellence, the strongest stays are upon the sides. It is true that it derives much support and is covered in, ligaments and all, by an extension of the fascia lata or strong covering of the thigh which closely adheres around the joint, and which in some degree takes the place of a capsule. This investment is denominated the general involucrum of the joint, and is extended down to cover in and confine the muscles of the leg in their places. When this structure is dissected up from the entire joint, we find upon the back part the posterior ligament of the articulation, or the ligament of Winslow. This consists of strong bands of fibrous material stretched from the external condyle of the femur, to the internal side of the head of the tibia, performing here the office of a part of a capsule. This ligament is in a tense condition only when the limb is extended, being lose and projecting when the member is flexed. Now in this condition it would have been liable to be pinched, and obstruct the free motions of the joint; to prevent this it receives a part of the tendon of the semi membranosus muscle, by the action of which it is prevented from these occurrences. The bands of fibres constituting this posterior ligament are not regular either in their course or origin but are always so arranged as to produce the intended effect. To prevent excessive lateral motion and also rotation of the joint we have the lateral ligaments, situated one upon each side. Upon these specimens are shown these ligaments, and you may perceive their great strength and the manner in which they support the joint.

On the external side of the joint there are as you see two of these ligaments, both of which arise from the external condyle of the femur, and are inserted into the head of the fibula where it is made rough for the purpose, The inner ligament of the articulation is a single broad and strong band extending from the roughened depression in the internal condyle, to the inner posterior part of the head of the tibia, It will be noticed by you upon inspection of these ligaments that they both occupy a position posterior to the long axis of the limb, or the transverse diameter of the joint, bounding exclusively its posterior half. Now by this arrangement the excessive flexion is admitted to take place readily, - and excessive extention which is not required is as successfully precluded, for when the bones are brought into a straight line, the largest portion of their extremities being anterior to these ligaments they of course present an insurmountable obstruction to a greater extension without luxation, In the extended position when these ligaments are made tense, there can be no lateral or rotating motion whatever executed on account of the firmly fixed condition of the bones, but after flexion has taken place even to a slight extent, a limited motion in that direction can be accomplished, - the use of which enables us to throw out in some degree, the toes, which is so necessary in locomotion We have then surrounding this joint for its protection and to increase its strength, as well as to aid in producing its motions, first anteriorly the ligamentum patella then the lateral ligaments, and posteriorly the ligament of Winslow, Enveloping the joint and lining the inner faces of all the ligaments and tendons, we have the synovial membrane by the secretion from which all the parts are lubricated and kept in the condition best adapted ~~for~~ free and extensive motion. This synovial cavity extends about 2 inches above the extremity of the cartilaginous surface of the bone for the purpose of facilitating the motions of the great extensor tendon, upon each side of which you may see it bulging when filled with air as in the specimen before us. Now here, although covered by cellular tissue, and thickened by maceration in spirit, you see it is still so thin as to be semitransparent, and this may give you some idea of its extreme tenuity and delicacy when existing in a natural condition, In inflammations of this membrane which result

in serous effusions as they most commonly do, the fluctuation is first perceived by striking or pressing slightly upon the patella with the limb in an extended position, when by its being raised up by the fluid beneath, you will be able to compress it downwards upon the bone, with which of course it always remains in contact under ordinary circumstances. It is also in this position upon the sides of the tendon above the joint that the tumefaction resulting from a distension of the membrane is first noticed. This region is to be carefully avoided in operations about the joint, on account of the liability to a wound of this prolongation of the synovial sack which would give rise to an inflammation which would involve the whole of the joint below in its serious consequences, or, establish a synovial fistula which would be found under ordinary circumstances very difficult to heal. In dropsies about this joint it has been however recommended to tap the membrane in this position as the only one where the is not pressed upon by the surrounding ligaments and tendons. When we strip off the whole of the ligaments and tendons surrounding the joint, we expose to view two inter articular cartilages of the same class with those which we have found interposed between the articulations of the clavicle with the sternum and acromion, answering the same purposes of increasing the extent and facility of motion. These are called from their shape the semilunar cartilages of the joint, and are placed upon the outer margin of each surface upon the tibia being thick upon their outer edge, and gradually bevelled down to a sharp semicircular edge internally, by which the cavity for the reception of the condyles of the femur are deepened. These are attached by their ends to the anterior and posterior end of the spine of the tibia near the insertion of the crucial ligaments, and also by their outer margins to the ligaments and membranes surrounding the joint by which they are confined to their position. The internal one is the largest and most semicircular, whilst the external is smaller and forms the largest part of a circle; these are analagous in structure, and somewhat so in function to the glenoid and cotyloid ligaments which they appear to represent in the knee joint.

The anterior attachments of the two are as before noticed near to the insertion of the anterior crucial ligament

and fasciculi of fibres run across from one to the other. It has been stated by Mr Hey that these Cartilages may under circumstances of relaxation of the ligaments surrounding the joint, become displaced in the motions of the joint, by the posterior part of one of them becoming locked under one of the Condyles during flexion, and the motion being continued it slips before the condyle and prevents extension from being accomplished. This he calls a subluxation at the knee joint, and the plan recommended by him for its reduction, is to flex the leg upon the thigh to the utmost, and then by a sudden motion to extend it, when he says the Cartilage will again slip back to its place. This occurrence is however I think very questionable, as it is difficult to see how these Cartilages attached all round to the external ligaments of the joint, can by any reasonable relaxation be permitted to go so far from their natural position. Within the joint, forming its internal structure we have two strong ligaments which from their crossing each other have been called the Crucial ligaments anterior and posterior on account of the origin and insertion of the one being from the anterior part of the external Condyle into the anterior part of the spine of the tibia, the other from the opposite side posteriorly. If you are desirous of remembering the exact origin and insertion of these ligaments you can do so readily by recalling the succession in which the vowels are arranged A. E. I. thus the Anterior from the External condyle from its Internal face, and the other of course from the External face of the internal Condyle, its insertion being into the same spine posteriorly. The office of these ligaments is that of preventing too much twisting motion in the joint, which however is limited more in one direction than in another. They are as well the main ligaments to resist flexion & extension Now you see that when I attempt to turn this tibia inwards, the anterior ligament is immediately put upon the stretch and limits the motion to a very small extent, whilst in turning it in an opposite direction I am enabled to carry it to a much greater extent. This is evidently admitted to give extent to that turning of the toes outward of which I have spoken before, and is restricted by the arrangement of one ligament posterior to the other, which could not possibly have existed if these ligaments had been arranged upon nearly the same level, as you must see that that would have restricted the motions as much in

one direction as in the other, This beautiful arrangement is well worthy of your attention as affording an example of that adaptation of parts to scrupulous necessities of the economy, We find some ligaments of no great importance, indeed which do not deserve the name of ligaments, as they are mere reflections of the membranes surrounding the joint,, You will notice that where the ligament of the patella passes from this bone to the insertion, there exists a quantity of fatty matter, which acts upon the principal of a stuffing to the parts, This fat which as I have before told you when speaking of that which occurs in other joints under similar circumstances, - was considered by Havers to be the synovial glands, - This secretion being, however as we now know secreted by transpiration from the membrane, To confine this packing in its place we have some duplications of a membranous character, extending from each side which constitute the ligamenta alaria, exerting however no influence upon the joint, Another duplication of the synovial membrane and cellular tissue which passes from the lower end of the patella through the notch between the condyles to be inserted upon the anterior part of the spine of the tibia, is denominated the middle ligament or ligamentum adiposum or mucosum, These are very pretty arrangements and are worth your while to notice, but are perhaps of no practical importance, Below this mass of fat, and between it and ~~the~~ insertion of the tendon upon the tibia, and between the tendon and the bone, you see such into which I place the knife handle, This is lined with synovial membrane and constitutes what is called a bursa mucosa, which are placed throughout the body wherever there is considerable friction which they are intended to prevent, This bursa is liable to disease, which sometimes becomes very troublesome, but not so much so however as another one of the same kind to which I call your attention in this specimen,, This is situated for the same purpose with the last, between the skin and the tendon, and is very liable to become inflammed from contusion or other causes, producing a most troublesome and often intractable affection, This occurs to such an extent in London, from the exposure to pressure to which it is subjected in house maids as to have had applied to it the designation of "house maids knee". Several cases of this kind have come under my notice

having recently had to treat it in the case of a Methodist preacher. One more demonstration gentlemen and we shall have finished the consideration of this structure. You may see by this preparation ~~that the~~ in which the whole of the investment of the joint is laid open that this is not more than the ⅛ of an inch in thickness at the thickest portion, being in some places much thinner. Now in White Swelling and other diseases about it this covering comes to be thickened to a half inch or more, involving with it all the surrounding structures. Now it has been said by Sir B Brodie that all this thickening is due to ~~the~~ thin gossamer like membrane which I have shown you to surround the joint for the secretion of fluid to lubricate it. Now with all deference to the opinion of so great a man, I must say that at least in my own experience this is not true, for I have seen the ligamentous structures involved even in the early stages of such affections. That they may commence by an inflammation of the synovial membrane I do not for a moment doubt, and that this membrane becomes thickened, but not that it constitutes the whole affection. The implication of the surfaces in these cases has been adduced to prove the extension of the synovial membrane over the ends of the bones, a point which as I have already told you is sub lite, there being much to be said both for and against it, but of this I am certain that if it does exist there it is under a form so modified as to exhibit none of its ordinary attributes. That it exists there however in the foetal state is equally certain.

We next take up for study the bones which constitute the foot a basis of sustentation for the body. This member is somewhat analagous to the hand in the arrangement and number of its bones, having the same number of metatarsal bones and phalanges that we find in the hand and placed in a somewhat similar manner, although executing a very different office. In animals however, particularly those which only use their fore extremeties to support themselves upon, we see the constitution and arrangement alike in both, each having the same function to perform. The foot of Man is arranged in an arched form by which to allow of the free action of the muscles vessels and nerves which are necessary to supply it as also to protect them from injury. This arched form throws of course the whole weight of the body upon the abutments of this arch, or upon two

points, the anterior ends of the metatarsal bones and the base of the os Calcis, In this examination of the foot we must first take up the bones which are the analogues of the Carpus or wrist, which are here called the

## Tarsus.

These are seven in number being one less than we find in the hand, they are named the os atragalus, the os Calcis or heel bone, the os scaphoides or naviculare, from its boat shape, the os Cuboides from its being somewhat cubical and the three Cuneiform, internal middle and external from their forming a kind of wedge in the foot. These three latter are all connected or articulated with the os Scaphoides by its anterior surface, To a brief description of these I will now ask your attention, The ~~os~~ astragalus which I here show you is secured between the malleoli to articulate with the tibia by a true mortice and tenant joint which forms that of the proper ankle, as I have shown you the end of the tibia grooved and covered both upon the end and the sides of the processes by one cartilage, so I now show you that the astragalus has an elevation by which it is accomodated to the tibia and is also covered by cartilage upon its top and sides for this articulation; upon each side of the bone too you perceive a depression for the attachment of the lateral ligaments The anterior surface of the bone is articulated by a head with the scaphoides which by the comparatively large size of the head to the socket is as you might suppose, intended for extensive motion and it is this extensive articulation which is principally concerned in that species of Club foot where the toes are turned inwards and the side upwards which is called talipes varus. Upon the under surface this bone is articulated by two facets with the corresponding surface of the os Calcis, these facets are separated by a deep groove or sulcus in which is lodged a very strong and dense ligament called the interosseous ligament, Now in falls upon the feet which frequently occur in which the force comes upon them obliquely from behind, this bone would be constantly liable to be displaced forwards upon the dorsum of the foot which would doubtless often occur if it was not that this dense ligament offers an effectual barrier to such direction of dislocation, The next bone which we have

to Consider, is the largest of those composing the tarsus and is called the os calcis. Upon its external side this bone is rough and irregular being covered only by the thick integuments, but upon the inner side we have as you see a very considerable depression over which my finger is now passed, called the sinuosity of the os calcis. This is for the lodgement of all those important tendons vessels and nerves which supply the foot, and to which it was necessary to afford support and protection. The Back part of the bone is as you see quite prominent, an excess of which projection constitutes one of the peculiarities of the Black man. This is one of the abutments of the foot, and upon a rough ridge at its end is inserted the tendo achilles by which the heel is raised when we support bodies upon the fore part of the foot; the end of the bone above the insertion of the tendon is as you perceive bevelled off so that in strong flexion of the foot the sharp edge of the bone might not press against the tendon and give rise to inconvenience. The lower part of this bone is covered not only by a thick skin but beneath this by a dense cushion of fatty matter interspersed with tendinous fibres running in every direction and binding it firmly together. Hence is is that a contusion or what is commonly called a stone bruise is so painful in this part, It gives occasion to swelling and infiltration into a part which is not capable of yielding and therefore the compression must give rise to great pain, This bone as before mentioned has two surfaces for articulation with the astragalus with a fissure between them, It is also articulated by its greater apophyses or head to the os cuboides, to which it is connected by a number of strong ligaments arising from the neck or narrowed portion of the bone, To the remaining bones and ligaments of the foot I shall have the pleasure of directing your attention when I meet you again.

**Lect. XVIII.** I wish to day to call your attention to the remaining part of the anatomy of the foot, I have as you will remember at our last meeting, described the two largest bones of the foot namely the astragalus which articulates with the tibia and the calcis or heel bone, with the anterior part of which is articulated the cuboides or square bone, The first then which we shall take up to day is the os scaphoides or navicularis, This as you will notice is boat shaped upon its posterior surface, for articulation with the head of the astragalus, - is convex upon its upper surface by which it contributes to the general convexity of the dorsum of the foot, and concave below, forming a part of the tarsal arch, Upon its inner side we notice a projecting prominence or irregular tubercle, which is called the tubercle of the os scaphoides, This marks the insertion of the tibialis posticus muscle and is a very important landmark, as it is all-ways to be felt beneath the integuments; for it is by this that we are always enabled to find what is called the middle tarsal joint, This it is of some importance to remember, as without a close familiarity with these bony structures, you will never be justified in under-taking the operations, which injuries about the foot now so often make necessary, - of amputating at these dif-ferent joints, Now when we know that the line of the middle tarsal joint as it is called commences immed-iately behind this prominence, and passes between the astragalus and scaphoides and between the os calcis and cuboides, and make our arrangements in accord-ance, we have no difficulty in undertaking the amp-utation here, so commonly known as "Chopart's method. When the parts are so swelled as to obliterate this point we may also find this middle joint commencing 3/4 of an inch below the internal malleolus, thus you see by being well acquainted with the parts, we need nev-er be at a loss, a simple running of the finger along the internal side of the foot affording every information. In this operation you insert your knife into the joint upon the inside, and bending it down with the attendant find that by cutting in a slightly convex direction you will separate the parts without difficulty. Upon this tubercle is inserted not only the tendon of the tibialis posticus but also the strong calcaneo scap

-loid ligament of which I shall presently have to speak. Upon the anterior face of this bone may be seen three dist-inct facets upon which are articulated the three Cuneiform bones. These facets form a kind of triangle with the base presenting upwards to the dorsum of the foot, the correspond-ing shape of the three bones having given them their name as they form a wedge in the construction of the foot.
The largest one of these three is the internal which I here show you in its relation with the scaphoides, it is as you see somewhat triangular presenting the apex ~~downwards~~ upwards. The middle or smallest of the three lies immediately along-side of the last one, and is perfectly wedge shaped presenting ~~also~~ its apex downwards, which however comes short of the level of the first one and therefore forms no part of the plantar surface of the foot, - its horizontal diameter also is shorter both ways, than those of the external or int-ernal. The third or external Cuneiform is received upon the remaining space of the scaphoid having attachments of course also to the metatarsal bones. When these three bones are placed in their position, you will see that the shortness of the middle one forms a kind of mortice between the other two, ¼ of an inch deep externally and ⅓ of an inch internally, into which is received as a tennant, the head of the second metatarsal bone, making a break in the line of articulation similar to that which we found in metacarpo carpal joint, and forming the principal obstruction which interferes with the amputation at the metatarso-tarsal articulation. In addition to this inlet of the bone there exists here covering it, three strong ligam-ents, which if not cut properly will give rise to a great difficulty or entirely prevent the operation. Thus a very precise idea of these arrangements is indispensable to a successful operation. The skin and tendons should be first divided down to the bone, in a convex direction to afford flap and then whilst the integuments are pushed back by the fingers of an assistant the knife is to be inserted vertically into the joint cutting in a regular line until we come to this second metatarsal bone when it must be turned up and after cutting for ¼ of an inch again turned transversely for half an inch, again forwards for ⅓ of an inch and then out to the edge of the foot after the dorsal ligaments have been divided; those upon the

plantar surface are readily seen by bending down the foot, being in this position cut with facility.
The next bone for consideration is that which from its square shape is so well named the Cuboides. This gentlemen may be, and is no doubt, a very dry study, this being anat-omy, but from the important part which it has to play in your future acquisitions, as well as its absolute necessity as enabling you to perform the operations which are daily required at your hands;- it becomes a matter of serious consequence to you. This cuboid bone is attached poster-iorly to the os calcis, having also a small facet for artic-ulation with the external cuneiform. These facets are lined by cartilages as in other joints, being interspersed with fossa running in different directions for the lodg-ment of the strong ligaments which serve to hold them in their places. The extremity of the scaphoid bone is received into such an fossa, where it is firmly articulated. Upon the anterior part the articular facet is divided into two by a slight ridge, these are for the accommodation of the fourth and fifth metatarsal bones, the rest being received upon the three cuneiform. In consequence of the shape and size of the head of the fifth metatarsal bone, it forms a prominent projection upon the side of the foot upon which is inserted the peroneus secundus mu-scle. This prominence in the construction of this bone not only receives the peroneus secundus but also a strong ligament which aids in binding the bones together. As these parts so nearly correspond with those of the hand, I shall be content with going briefly over some of the more important parts, the general characters of the metatarsus and phalanges being the same. The first or metatarsal bone of the great toe like that of the thumb is much the largest and thickest, being articulated with the cuneiform by flat surfaces which ad-mit of very little motion, which is not necessary here. The second bone is, like the second of the fin-gers,- longer than any of the rest in consequence of being received between the two cuneiform bones. The third and fourth are regular and differ only in being progressively shorter and somewhat sm

-aller, The fifth has however the enlarged extremity and projection to which I have called your attention and which forms the second grand land mark in operations upon these joints, By ~~this~~ which is always recognisable below the integuments we can always find what is called the Meta~~carpo~~tarsal joint, amputations at which point are frequently had recourse too, This joint of course lies immediately behind this projection, and about 3/4 of an inch from the middle joint upon the outside of the foot, - on the inside it may be detected often by the swelling out of the head of the metatarsal bone of the great toe, or else by measuring 1¼ inches forward from the scaphoid pro-tuberance, You may see that the directions of these lines are slightly convex, in consequence of which your incisions must be convex also, I cannot too frequently call your attention to these points, as their anatomy is so much concerned in the operations upon them, These metatarsal bones are slightly convex upon the dorsal and concave upon their plantar surface, for the accom-modation of the vessels tendons nerves and so forth, which pass beneath them and which it was necessary to protect from pressure, Their sides are somewhat flattened, leaving interstices for the lodgment of muscles, which have their action either upon these bones or the phalanges, At the ends of these bones we have the phalanges, which with the exception of being shorter are simple copies of those of the fingers, having the same kinds of articulation, the same shape, and direction, The last phalanges are also arranged with the same bony expansion, to give attachment to the nail, and also to accommodate that bed of soft tissue upon which the papilla of touch are distributed This arrangement here might seem unnecessary, as we do not possess that delicacy of the sense here that we have in the fingers, but in the primitive native state I suppose that the sense did exist here to as great a degree, and that its destructions by our civilized habits of wearing boots or shoes although destroying the sense to a great degree has not been able to modify the structure upon which it was based, I shall next call your attention to the ligaments of the foot, These are exceedingly numer-erous, rendering an intimate knowledge of each one as

difficult as it is useless in a practical point of view. I shall therefore not take up your time with a description of them all, merely touching without mentioning upon those small ones which do not ordinarily affect us. A more copious examination being tedious troublesome and unnecessary. Then first we see upon this specimen that the aponeurosis or fascia of the leg extends down over the ankle joint, investing it closely and looking like a capsule around it, other than which this joint has no particular investment. This after passing the proper ankle joint becomes divided to reach its various attachments, and presents a lacerated appearance from which it has been termed ligamentum laciniatum. This ligament is often concerned in the common sprains and other affections of the ankle, having its fibres torn or ruptured. Beneath this we have arising from the tibia and passing outwards to an insertion upon the external malleolus, a very strong aponeurotic expansion, whose office

Plantar Fascia

it is, by surrounding the joint to keep all the various tendons in their places, applied closely to the bone, otherwise every action of the muscles would be attended with a starting out from their places of these. This is called the anterior annular ligament, under which as I raise it, you see the various tendons playing. Next as this is a hinge joint and in some respects like the knee, we have the strong lateral or side ligaments which perform the greater part of the office of holding the bones together, although many others are found surrounding them. These like those at the knee permit no lateral motion when the leg is in an upright position upon the foot, but when depressed backwards allow of considerable turning. Now the arrangement of the ligaments here forms one of the peculiarities of man, for in all animals the os calcis or heel bone is prevented from coming in contact with the ground the support being by the anterior bones of the foot. In these the os calcis forms what is known as the hock bone which is found some distance above the proper surface upon which they stand, man being the only mammal whose foot can be placed flat upon the soil. This joint is protected both behind and before by the various ligaments which cover it and limit its motion

but its great strength is derived from the existence of the proper external and internal lateral ligaments by which the apposition is maintained, The external one of these arises from the whole of the external malleolus by a very strong attachment, afterwards dividing into three parts to be inserted into, first, by the anterior fasciculus into the scaphoid and cuboid bone, - second by the middle one to the os calcis and astragalus and lastly by the posterior, into the posterior part of the os calcis, These are so placed as not all to be made tense at once, each bearing upon a particular position of the foot, checking these particular motions, Upon the inner side we have a still stronger and longer ligament, This arises from the point of the internal malleolus and spreads from this to an irregular insertion upon the os calcis and astragalus, forming a kind of triangular figure, from which it has been called the deltoid ligament, This is much stronger than the external lateral ligament, being ¼ of an inch thick, We next observe that the astragalus and calcis are attached together not only by the strong interosseous ligament which has been spoken when considering the bones, as being lodged in the fissa between them, but also by a strong one above and below, the upper only being here shown, which are called the calcaneo astragaloid ligaments, Again we notice this ligament upon the dorsum of the foot whereby the astragalus and scaphoides are held together, there being also another below, which is not here shown, And next the manner in which the calcis and cuboides are attached This is accomplished by two ligaments which are here very well shown; these are called inferior and superior calcaneo cuboid ligaments, The superior are found to be a strong layer upon the dorsum of the foot, and the inferior which is a very important one, in as much as it gives support to the whole of the outer side of the foot This portion arises by a very strong origin upon the os calcis upon its outer face, and divides into two portions denominated from their extent the long and short portions, The short portion is inserted into the os cuboides, and some of the surrounding bones, whilst the longer one extends to the metatarsal bones, stretching over the tendon of the peroneus longus muscle, forming a kind of ligamentous covering to it. Now I believe that a great many of the

stubborn affections of the foot which we have to treat, and which after giving so much trouble to physician and patient; so often result in incurable lameness, - may be attributed to these ligamentous sheaths, which surround the tendons; for inflammation developed in them, from their unyielding nature must of necessity be very painful and their depth of position rendering them inaccessible by ordinary means, As I do not wish to be minute in these descriptions, I shall only now mention, and show to you that there exists a very strong and important ligament between the Calcis and Scaphoides, called the Calcaneo scaphoid, which however differs from the other ligaments in being of a somewhat Cartilaginous nature, and in being elastic, This not only serves to strengthen and support the bones in the arched form of the inside of the foot; but also secures a part of the astragalus upon it which it supports. Serving as a spring in jumps or falls upon the feet, to break the shock which would otherwise perhaps force the bones from their places down into contact with the surface,

The mass of small ligaments upon the upper and lower part of the foot I shall not stop to particularize; as it would only be embarrassing to burden your memories with points of no practical import, They may well be divided into two ligamentous investments, dorsal and plantar, and be thus described in mass, - but to a few of the particular portions I shall first call your attention, Then from the Scaphoides you have radiating to each Cuneiform bone a small one, - from them again to the metatarsal bones you have others, and these we may notice as forming in this irregular part of the articular line, the principal difficulty in the amputation here, - To see them well shown upon this preparation, and the manner in which they must be divided, These form as it were a key by which the head of this second metatarsal bone is held in its place, These bones are all articulated with each other in the same manner as at the wrist joint, and the plantar surface is similar to the dorsal with the exception that some of the ligaments here proceed across to form a sheath

for the peroneus longus muscle which we have seen crossing the sole of the foot, Now a case occurred some time since to me, in point to what has been said of inflammations of these ligamentous thecae, A boatman whilst endeavouring to push off his boat from the strand, placed his foot against the side of it with so much force as to give him great pain, which continued in despite of every thing that was done, and finally resulted in continued lameness, I have no doubt but in this case, the pressure developed an inflammation in the synovial sheath of this tendon, which being confined could not relieve itself, and in consequence resulted as before said, We have in addition a transverse ligament between the toes to keep them together as we found in the hand, We next notice for an instant the grooves or passages behind the malleolus, for the transmission of the various tendons of the foot, — Behind the internal malleolus then we have first the passage of the tibialis posticus muscle going to its insertion upon the scaphoid bone, and next a groove for the accommodation of the tendon of the long flexor of the toes both of which it is sometimes necessary to divide in the operation for club foot, it sometimes being necessary to cut also thecae which are found contracted and resisting, Behind and deeper than either of these we have the groove for the tendon of the flexor policis pedis, between which and the long flexor of the toes usually pass down the vessels and nerves to be distributed to the plantar surface of the foot, These are all surrounded by proper thecae lined by synovial membranes proper also to each, These thecae are sometimes ruptured by accident, which when occurring always gives rise to much trouble, These tendons and sheaths serve also the purpose of supporting the bones in their places, and protecting them from injury, serving in this the offices of ligaments surrounding the joints, — We have now gentlemen finished the dry study of the bones and ligaments with sufficient minuteness I hope, to give you the necessary ideas of their important practical points and relations and when we meet again shall take up the consideration of the soft parts,

**Lect. XIX.** It has been customary heretofore, in teaching anatomy by what was called a systematic course to begin by an examination of the osseous structure, and afterwards to go on by describing first the ligamentous, then the muscular system, then the arteries, following these with the veins and lymphatics, and afterwards concluding with the nervous apparatus. And in this way I am satisfied that a pretty good theoretical view of these different systems may be obtained; but with regard to their practical bearings and relations, there has always appeared to me to be a deficiency of knowledge which might be the result of the mode in which the study was pursued; and in that case admitting of remedy. Now in as much as we study the muscles in a practical point of view, in reference to their physiological uses, what are of less pressing [illegible] principally as the guides by which we must be directed in our operations especially for locating the arteries to the other and more important parts, which are certainly primary, both as regards their functions, and the interference which they require from us; for, what are the muscles especially those of animal life but the instruments of the nervous system by the secondary aid of which our economy is built up, preserved, and brought into ~~relations~~ with the world around us, — the mere physical interposition between cause and effect. Then if we regard this, as we must, as the means by which the arterial and nervous systems ~~perform~~ extend the result of their functions to the constitution of an animal organism, I can conceive that we may derive more benefit from considering it in this secondary point of view; because it then takes its proper place as the necessary additional existence to the complete expression of vitality.

Therefore instead of entering as usual at once upon the muscular structure, I shall, now that we have the bony foundation to go upon, commence with a description of the great centres of the system, and first with the brain and spinal marrow. There are then two distinct centres of nervous influence, the one appertaining to organic, the other to animal life. Of the first we shall not speak at present, simply acknowledging its presence in the great sympathetic system, by which all those involuntary or vegetative functions are performed, being at the

same time totally unaffected by the ordinary excitants to sensibility, These may be cut or pinched without develop-ing any pain, and are entirely beyond our voluntary control for instance we can at will neither hasten or retard the action of the heart, ~~or of the~~ or of the intestines, Here upon these drawings you have representations of the two systems in contrast, being as you see entirely separate and distinct, but taken together constitute the entire nervous system. The nervous centres of ~~organic~~ animal life with which alone we shall at present concern ourselves, consists of three parts first the ~~galvan~~ ganglionic portion or that in which the nervous influence is manufactured, whether this be galvanic in its nature as many suppose from the certainly very close analogy which it presents, or whether it be any thing else, Secondly we have, as well as a labratory for manufacture, channels to conduct this influence to positions where it is requi-red, and thirdly we have the Commissures or Connections between these different manufactories by which they are placed in communication with each other. Thus we have three parts of which the whole system consists, any part which we can find being always referable to one of these The older anatomists were in the habit of describing this system by commencing at the brain and after ~~de~~ examining that to take up the nerves as they are given off from above down-wards untile they came to the spinal cord, Since the time of Gall and Spurzheim however a different mode has often been pursued, namely that of the order of developement. It was shown by these anatomists that in the foetus the spinal marrow was first perceptible and that the brain was developed upon it as a ganglion as it increased in size and approached the more advanced state, and that as this developement went on the cavities for their lodgment also became formed, and adapted in the best possible m-anner for their protection, In the vertebra which we have recently studied we have seen in what this arrangement consists and how admirably it is fitted to fullfil the end, The whole spinal marrow which I here show you has been exposed by sawing through the bridges of the ver-tebra on each side and removing the whole posterior part with the spinous processes, Now you perceive that this is covered by a smooth glossy membrane of a fibrous structure extending over the whole cord and also upon the brain

where it fulfils the office of an internal pericranium or perios-
-teum, being attached to the bone by vessels which pass from
one to the other, the rupture of which in stripping it off as
has been done in the case before us, leaves the bone marked
and covered by small bloody points. This Dura Mater as
it is called, although not loosely attached to the bone is
nevertheless liable to be dislodged by shocks, when the
hemorrhage from the ruptured vessels is likely to produce
what is called an external clot, whereby pressure is exerted
upon the brain and very serious consequences result.
The difference between the Dura Mater ~~and [illegible]~~ of the
brain and that of the spinal cord is only that in
the former its adherence to the bone gives to it the ch-
-aracter of periosteum, whilst around the spinal cord
it constitutes a loose covering or envelope being in
attached only by the processes which it sends off with
The spinal bones having their own periosteum
the spinal nerves. The point at which it first bec-
-omes adherent, as at the Atlas vertebra marks the
arbitrary division between brain and spinal ma-
-rrow, and here the adhesion is very close, requiring
to be divided artificially as you see; below this this
tube or sheath is entirely independent of the vertebral
column ~~canal~~ ~~bones~~, each of the bones of which has its proper peri-
-osteum. The small quantity of cellular tissue which
is found between this sheath and the bone, a portion
of which I here draw out, — filled as it is now with
blood and serum, — it is very important that you should
remember, as in inflammation it sometimes swells so
as to exert a pressure upon the cord and produce a
paralysis of the parts below. The Dura mater may
be traced down through the canal to the entire end
of the sacrum, enclosing at its lower part not the
proper cord, but the nerves into which it divides as we
shall see presently. From it upon each side we see
passing off a number of tubular processes, which
will be found to cover the nerves as they emerge, — two
[illegible] intervertebral foramen
of these upon each side I here raise up to view.
Of these we have sometimes 30 at others 31 pairs passing
from the whole course of the spinal tract and accompany-
-ing the spinal nerves which they invest from the
canal to the various parts of the system. These do not
simply cover the nerves until the get out of the canal

and then cease, but are continued throughout the body branching with the branches of the nerves, so that wherever a nerve may be found it always has its prolongation of dura mater & probably the other membranes around it, This covering is called the Neuri-lema of the nerve, and wherever found, has always its primary origin in the dura mater which surrounds the nervous centres, We next proceed to open this dura mater, and we shall in this instance find it filled to an inordinate degree by fluid, And the first thing that strikes us is that the tube appears to be much larger than necessary to contain the comparatively small cord which we find enclosed. You now see the fluid which flows out, which has been called by Magendie the sub-arachnoid fluid; he conceived this fluid to be very important in the economy believing that it circulated up and down the column and performed some important part in the function of the brain and cord; but we now also know that a good part of this is frequently formed after death and that its quantity varies very much in the different modes of death, In this case for instance it amounted almost to a dropsy, and could not have existed coincident with health. As we open this sheath on the posterior part we bring into view a very thin delicate membrane, analogous to those which we have seen in the joints, This as you may see is perfectly transparent and like the synovial membranes, is serous in its character, or secretes a serous fluid by which friction is destroyed, This is the Arachnoid membrane of the spinal cord, and is continuous with that of the brain, lining closely the whole of the inner side of the dura mater being reflected by an other layer, like all serous membranes, over the chord, giving it also a complete investment, In the sack thus formed, is found the sub-arachnoid fluid, which when amounting to as much as here present, we may consider as a pathological result rather than a natural effect. When I raise the outer layer or that which lines the dura mater, you see shining below it still another which is the reflection over the cord, which is also somewhat loose This may be traced to the processes where the nerves are given off and by supposition, for it has never been demonstrated, goes off with the neurilema to give an investment to the nerves in their course through the body,

I now proceed to open the the dura mater and arach-

-noid, the whole length of the Canal; and you perceive how loosely the Cord is invested for the whole length. The fluid which was at first noticed to be so abundant has from the position of the subject leaked out leaving the Cord in a natural condition. We now have brought into view the proper investment of the Cord, which covers it closely throughout, and which you see in this case is coloured by the vascular congestion which has followed death. From this we can judge of the extreme vascularity of this membrane, appearing as it does in reality to consist of a mass of vessels held together by condensed cellular tissue. This membrane is continuous with that which covers the brain, dipping into its convolutions, and investing every part of it, whilst the arachnoid which covers it is spread smoothly across the fissures. This seems to consist of condensed cellular tissue spread over the surface as a bed in which the vessels ramify and divide before entering the brain. We may well suppose that an artery of any considerable size entering the brain would affect it by interfering with its delicate functions, and hence the necessity of some arrangement by which they may divide and sub-divide into capillary minuteness before entering the organ. This close investment with the function which it performs, have given to this exceedingly vascular membrane the designation of Pia Mater. Upon this preparation you have a view of the arachnoid membrane rendered opaque by coagulating the fluid in its vessels, and you may see that this also is eminently vascular although quite transparent, this arises from the fact that its vessels are so minute as only to carry white blood which of course does not affect its transparency; when found opaque after death it is evidence of inflammation having existed. You will notice the position in which the subject is placed to give an entire extended view of the Canal and Cord but you will remember that the variety of positions in which the body is placed during life must if these structures were loose in the canal give rise to various modifications in their situation; now in many of these the cord would be liable to be compressed, which would result in death. It is therefore in consequence of the necessity of keeping it free from such occurrence

that we have the beautiful arrangement which we now come to notice, namely the means by which the Spinal marrow is suspended in the center of the Canal and kept free from contact with it, This is accomplished by some tooth like processes which taken in the agregate are known as the ligamentum denticulatum, These are found upon the sides of the Cord, and consists of a process from the pia mater upon each side of the great longitudinal fissure meeting each other and being inserted upon the inner surface of the dura matter, thus suspending the cord as it were in this fibrous sheath, which in its turn is kept in the centre of the bony canal by the adhesion of the processes surrounding the nerves which are given off in its course, - to the bony foramina through which they pass out, Here you see upon this magnified diagram of a section of the Spinal Cord of the Elephant, the parts being too minute to be seen distinctly upon the human subject, - the manner in which this indication is effected, and from it can suppose how perfectly free the Cord is from all friction and pressure in the different postures to which the body is subjected. This is another of the beautiful contrivances by which nature guards herself against the deranging occurences by which she is surrounded, The Spinal Cord is of an oval shape being about ½ an inch transversely and rather less in its antero posterior diameter, having upon ~~each~~ its posterior and anterior surfaces two fissures, dividing it into two lateral portions, Now we find the pia mater not going smoothly over these fissures as the other membranes do, but dipping into them and therefore forming a doubling of this membrane in each fissure, which when I exercise traction upon I am enabled to draw out, leaving the substance of the Cord exposed, Now you may see by an examination of these processes given off by the dura mater to surround the various nerves in their passages, that at their entrance into the intervertebral foramen they become implicated with the periosteum of the bones, forming a strong adhesion Now it must be evident that in the usual mode of determining the existence of Spinal irritation, or of neuralgias seated in any particular part of the Spinal track, by pressing upon the Spinous processes of the vertebra, we are very far from accomplishing the desired end in

the manner proposed, for it is supposed that by this pressure we cause the vertebra to move over each other and thereby cause a pressure upon the membranes inside of the canal, which if they be in a diseased condition will cause pain, Now I believe from a consideration of the anatomy of these parts that if we accomplished the object of compressing in the slightest degree these extremely delicate membranes, we should have pain of no mild character which would spread throughout the whole tract, like electricity over a sheet of zinc and probably develop an inflammation by the endeavour to detect one, Then the only effect which I can conceive of in this pressure, is to develop a pain by the transmitted pressure upon these nerves as they go out where the membrane is continuous with the periosteum of the bone, this fact being entirely sufficient to account for the effect, - this too is more apparent upon the roots of sensation, as we know that upon each of these just within the foramen is a nodule or ganglionic expansion serves more completely to fill the sheath, I for these reasons believe ~~that~~ that the only effect of these means, is to develop a rheumatic pain by disturbing the membrane of these nerves instead of finding the seat of a preexisting one, - the pressure easily enough developing inflammation and swelling in the parts, We must notice that although the membranes continue down to the point of the sacrum, yet the true spinal cord terminates about the first or second lumbar vertebra, as you see, this ligamentous cord or apparent prolongation being only the remains of the ligamentum denticulatum, At this point the cord divides into a multitude of fibres like the cords of a whip, or more coarsely compared to the tail of a horse, from whence the name of Cauda equinæ, these however do not immediately quit the membranes but continue down inside, being distributed along as they descend, to the lumbar and sacral regions, from whence they form the nerves of the lower extremities, This termination of the cord so high up in the canal is the result of the rapid comparative development of the bones in their growing state, for in the foetus

the Cord is extended throughout the entire length of the Canal, thus showing that whilst the bones grow in extent this structure either grows very slowly or remains entirely stationary, The filaments forming the Cauda Equina instead of having the ganglions developed upon their posterior roots after or whilst emerging from the sheath, have them often inside of these membranes, Each of these roots arise from the Spinal Cord by bundles of fasciculi and not by a single cord, as may be seen upon these preparations, these afterwards in one case being collected by ganglia, in the other only by the membrane of the nerve. Having now completed the study of the investments of the cord, we shall at our next meeting proceed with its constitution and functions

**Lect. XX.** I have to day gentlemen to make some few more observations with regard to the Spinal marrow, and with respect particularly to its structure and functions The true Spinal Cord is composed of two distinct substances distinguished as well by their adverse physical qualities, as by the difference in color which they present, There are an outer or medullary substance and an inner or Cineritious one; the first is of a white color and wherever found, in all parts of the economy is essentially fibrous in its character; the second on the contrary is found enclosed within the medullary or white substance, is of an ash grey color, - hence its name of Cineritious substance, - and is wherever found, of a granular structure, being made up of a great number of small granules, which being hollow within are called cells comparable to grains of sand only that they are so infinitely small that a cross section of the cord would exhibit to the microscope millions of them at a view, These granules are excessively vascular, and indeed it is to this that they owe their peculiar color, This from forming the Centre of the spinal marrow has been called the nucleus, but in fact is no nucleus at all but on the contrary appears from the manner of development to be rather something added to the medullary portion, This latter substance is that which is first perceptible in the foetus, appearing first as two slips of ribbon like substance united at one edge, the free edges gradually approximating until they finally unite in the middle line, enclosing a space within them which subsequently becomes filled up by

this cineritious substance; This cavity has been called while existing, a ventricle, and some have believed that such a cavity exists through life, and speak of it as the ventricle of the cord; but this has arisen probably from some experiments made upon it in a diseased condition, when fluids as mercury may be made to pass through it. The medulla spinalis consists of two symmetrical halves partially separated by means of the posterior and anterior median fissures, - a right half to supply the right side of the head, and neck, the right arm body and leg, and a left half to fulfill a corresponding function for the left side of the body, This separation by the fissures is not perfect, although the grooves are deep and well marked, The anterior median fissure is the widest of the two, the posterior being somewhat narrower but deeper, In the preparation which I present, you can see that when I pull out the pia mater, these are both quite considerable in extent, and here again by the large model I am enabled to make the demonstration to those at a distance, assuring them that this is not an exaggeration but has been constructed with the greatest accuracy of proportion, We may notice here that these fissures although penetrating deeply into the cord, do not entirely as might be supposed, divide the white or medullary portion into two distinct parts by passing through to the cineritious, but that there is a thin pellicle of this white substance passing under the bottom of each fissure, forming a complete connexion or commissure by which the two sides are placed in perfect communication with each other, for the purpose of harmony of action, The cineritious matter itself has been considered by some to act the part of a commissure, but this is not the case for medullary matter is alone capable of connecting the different parts and is always the only means of communication This we might readily suppose from its fibrous nature which is as positively proven as any fact with which we are acquainted, the fibres running along side of each other and branching off to the different parts with as much distinctness as in the twigs of a tree. The offices of these two substances which constitute the spinal marrow are just the reverse of each other

the white or medullary acting as a carrier of the nervous imp-ressions, whilst the cineritious gives origin to the influence. The shape of a cross section of this central cineritious substance is somewhat that of two letters C turned back to back and united by the broad band in the middle, the anterior and posterior median fissures coming as it were between them. The ends of the anterior horns of these C's are the thickest and it is at the points of each of these horns that we find the anterior and posterior lateral fissures upon each side. These are by no means so deep as those before described, and appear to be placed here only to facilitate the exit origin of the anterior and posterior roots of the spinal nerves which spring from their bottoms. Many of the fibres of the posterior roots may be traced into the cineritious substance through the posterior lateral groove, but in the anterior roots this is more difficult, and they are admitted to pass in rather by inference than from positive demonstration. We know by reference to the color of each that the anterior and posterior nerves pass out in separate sheaths. Each of the posterior roots is found to have upon it at a short distance from the cord, a small ganglion, this generally occupies the intervertebral foramen, with the exception of the nerves which constitute the cauda Equina when they are situated entirely within the canal, after passing this ganglion the fibres cannot be distinguished as they could before, being enclosed in a single sheath until they unite with the anterior branch when the two are united in one sheath and so commingled as to be in no degree distinguishable by the senses, although their functions are so different. These functions consist in communicating sensation and motion to the various parts to which they are distributed. The posterior branch always conveys sensation and the anterior, motion, hence the two tracts of the spinal marrow are spoken of as the sensorial and motor tracts. If we divide one of these posterior roots the effect will be a destruction of sensation in that part where it may be distributed, whilst the motions will remain perfect, and if we divide an anterior root, the converse circumstance will occur, whilst if both are divided, it is with the effect of perfectly cutting off both sensation and motion from a part of the body. Each nerve therefore in its distribution is composed of two parts the one sensitive

the other motorial, and although the nerve may divide into 50 branches, still each branch must have some of each set, although we are perfectly at a loss with regd to the proportions of each, the senses being no guide whatever; it is probable however that each nerve or each branch consists of half of each set, until they arrive at their place of ultimate distribution where a separation must take place, the motor fibres going to the muscles to give them motion, and the sensorial to communicate their attribute to the skin. It is by these means therefore that the difference of function has been discovered, and established, that by cutting the one you destroy its function; and the same with regard to the other. Now these facts have been proved beyond all doubt and it is very important that you should be acquainted with them, and keep them in mind in your physiological and pathological conclusions. The division into sensative and motorial tracts being established it has been enquired as to where the dividing line was, and some have supposed that the fissures alone were the seats of these differences, but facts do not support this idea it being more probable that it exists midway between the two sets of roots, but of the ultimate point no-one knows anything. These fissures are probably only coincidences, as it is not necessary that the roots should have been divided for the perfect performance of its functions, for we know that each fibril is invested with its cellular tissue which surrounds it entirely up to the brain or spinal marrow, insulating it perfectly, as we insulate our wires by wrapping them around with silk before employing them in our galvanic arrangements. We know that all the fibres constituting the roots of these nerves do not come from the cineritious substance but that $\frac{1}{2}$ or $\frac{1}{3}$ or at least some proportion not exactly defined passes up after striking the cord, to the brain, the remainder passing in and communicating with a corresponding set from the other root by interlacing with them. This communication of the extremities of the roots with each other in the cineritious substance has led to the establishment of that excito-motory system of Marshall Hall by which reflex actions are produced, without the intervention of the brain,

In a great many of the lower animals there exists only a set of ganglia composed of this cineritious substance which serves the necessities of the system without a brain, in the Catterpillar for instance whilst in the Crysalis state there exists only some ganglia by which the animal is governed but when about to rise in the scale, and become a butterfly these ganglia unite, new nerves are developped, from which arise the legs wings &c of the insect, and the change is then completed, We may therefore consider this cord as a simple pile of ganglia, which may act by the necessities which arise, without the interference of the brain In this large drawing after Mr Granger I have endeavoured to represent this system in a manner in which you can understand it, It is to be regarded as a profile view of the different fibres, and is quite analogous to the arrangement which I have myself seen in the spinal marrow of an Elephant, where from the increased size of the parts a much better view may be obtained, In the first place then you have represented the two sets of ~~roots~~ coming off one on each side, one sensorial and the other motorial Then in tracing this sensitive root to the cord, we see that after striking it, a number of the fibres are reflected up along the sides to the brain, these are called the Cerebral sensiferous fibres; whilst the remainder runs directly into the cineritious centre and these are called the true incident ~~sensorial~~ spinal fibres, Upon the other side we trace an anterior or motor root to the cord and we find in the same way that there are a certain number of the filaments reflected up in the same way, to communicate with the brain, being called the cerebral motorial fibres, and also a number proceeding into the cineritious substance constituting the true spinal reflex or motor fibres, where these communicating with the spinal sensative fibres to give rise to reflex actions in which the brain is not concerned, As an instance to explain the action of this system let us take the pneumogastric nerve which is partly destributed to the lungs, it consists of fibres from the anterior and posterior tract, which are in connexion as supposed, at their spinal extremities, well the presence of mucous in the bronchial tubes impresses the sensative filaments distributed there, these transfer the impression to the spinal marrow and excite the

motor filaments with which they communicate, these transmit the impression out again and the muscles are thrown into action, - Cough is excited and the offending mucous is expelled. Thus you see we have in addition to the Central system, this Spinal reflex system of nerves and the Spinal marrow is therefore no longer regarded as of old, to be a great nerve through which all impressions are transmitted to the brain. It is not a nerve alse because no nerve is found to contain cineritious matter which we have found in abundance in the cord. It is to be regarded therefore as a prolongation of or an appendage to the brain, performing the same functions and some of them in an entirely independent manner. We shall next take a view of the great organ with which this Spinal Cord is in connexion both as regards continuity and function namely

## The Brain

This organ is in connexion with the Medulla Spinalis which we have just been considering, by the intervention of the Medulla Oblongata, which is nothing more than a prolongation of the Spinal Cord within the Cranium, occupying the cuneiform process of the occipital bone which we have seen at the base of the skull, - and which consists of three bodies which however we shall notice hereafter. I had intended, and do still intend to demonstrate the brain in the manner in which I have commenced, namely from below upwards, but in as much as it makes it more complicated and more difficult to understand, I have thought it best, first to take a birds eye view of it in the old fashioned way of teachers, and after you have become somewhat familiar with its structure and arrangements to take it up in the new and perhaps better method and demonstrate it from below upwards. We have already noticed that the brain in common with the Spinal Marrow was covered by three membranes, the first or outer one of which we have here exposed, in which you see ramifying the large arteries which come up to supply these parts. This Dura Mater is here a double membrane, the doubling of which is closely united everywhere but at and near the middle line of the Cranium. Here however, whilst

the outside layer is continued across from side to side, in connexion with the bone, the inner layer is separated and dips down into the great longitudinal fissure of the brain, forming a kind of triangular cavity extending the whole length of the skull, which is the great superior longitudinal sinus for the conveyance of the efflux of blood from the upper portion of the cranium and brain, from which it is conveyed by the lateral sinuses out through the base of the skull to form the jugular veins. These sinuses are in no respect like the veins, being devoid of all contraction, and also of the the various coats of these vessels, the blood being propelled through them partly by the suction created in expanding the chest which must create an afflux to that cavity, and partly as I believe by the pulsation communicated to the brain by the hearts action through the arteries, pressing upon these sinuses and forcing out the blood. Now if we consider this dura mater as consisting of two membranes the one going continuously over the bone whilst the other is depressed into the fissure to form the longitudinal sinus we can readily understand this partial diaphragm which exists between the two sides of the brain for the purpose of supporting one side of the organ whilst we lie upon the opposite side, and preventing any derangement from the pressure which its weight would exert. This partition which is called the falx major cerebri, is extended from the crista galli of the ethmoid bone and from the adjoining frontal bone, through to the internal ~~occipital~~ protuberance upon the occipital bone, forming a strong and dense membranous expansion, consisting of these two layers of the internal dura mater held together before they meet by small cords passing from side to side called the cords of Willis. This falx has received its name on account of its resemblance to the ancient sickle ~~scythe~~, with its curved back and edge. Along the margin of this longitudinal sinus we find upon opening it a number of small bodies, called glandulæ Pacchioni, but which have not been proven to be glands at all, but probably have some close connexion with the absorbent system, none of the vessels of which having as yet been found in the brain. I will now open this longitudinal sinus entirely down, and you see in what manner the vessels of the membranes empty them

-selves into it, coming up in an oblique direction opposite to that in which the blood flows along these sinuses. I will now turn off the dura mater by an incision in the side and as I reflect it you see what a smooth and polished surface it presents towards the brain being entirely different from the outer surface which is but peri-osteum, you may see also the direction in which all the vessels run to enter the sinuses, Here I exhibit to you the arachnoid lining the dura mater, and presenting a slight opacity which characterizes inflammation of this membrane; its excessive delicacy you have before noticed which has given to it this designation from a resemblance to the spiders web. Under this we have the sheet of cellular tissue in which the numerous vessels lie, constituting the Pia mater, now whilst the arachnoid runs smoothly over the sulci between the convolutions, this membrane dips down between them, and when drawn out presents little cord like filaments which are the vessels going to the brain, I next call your attention to the large size of the sulcus occupied by the Falx Major between the two hemispheres of the brain, and to a white body which you see shining at the bottom of this fissure, which is the commissura magna cerebri or Corpus Calosum, We find the two sides of this fissure lined by arachnoid membrane and pia mater and constituting as much a part of the periphery or outside of the brain as the highest convolution we can find, - the convolutions which are so called from their resemblance to the turnings and twistings of the intestines of a child, - being as perfect here as at any part of the surface being intended only, wherever found, to give amplitude of surface for the extention of the function which that surface performs, and this end is admirably answered by the existing arrangement for packing so great an extent of surface into so small a space, for if by any means of forcing fluid into the ventricles we could expand and stretch out all these convolutions we should have a sack two feet in diameter, thus we see how much space is saved by this plaiting up of the surface, In this it is that man principally differs from animals in the large head and great excess of the outer surface of the brain which alone is concerned in the production of intellect. and the reasoning powers, as also probably some arrangement or balancing of faculties

We find the arrangement present in the Spinal marrow with regard to the two component parts, just reversed when we come to examine the brain, for here we have the Cortical or outside portion consisting of Cineritious or grey matter whilst the inside for the most part is medullary, the ped-uncles and Pons Varolii however being Cineritious. The med-ullary substance appears to have been here developed in a bag of the Cineritious, which we shall find to be only about 1½ lines thick, although extending evenly all over the whole organ. I shall now make an incision through the top of the brain by which to exhibit to you the Corpus Callosum leaving its examination for a starting point for our next meeting, and in doing this you will observe another arran-gement by which amplitude of surface is gained, namely the underlapping of the convolutions for half an inch upon the upper surface of the corpus callosum. You can perceive now in this part which I have removed the proportion of Cineritious matter which is distributed over the medullary in such a way as to be of the same thickness throughout leaving the white substance below convoluted in the same manner after its removal.

Lect. XXI. I shall proceed to day gentlemen with the regional Anato-my of the Brain according to the old method of Willis and Vieussens. This is not, as I have already mentioned to you, in accordance with the mode of development, or with the functions of the organ, as in both these points it is secondary to the spinal marrow as regards vegetative or organic life. This plan has the advantage of being the most simple and easily understood, but in its adoption we can necessarily say little about its functions. The other method, and perhaps the only correct one, namely that which has regard to the development and function, posses-ses many advantages over the other, but also the disadvantage of being more complicated and difficult of comprehension. I shall therefore commence by removing the brain from above in slices, previous to which however I may call your attention to this large model, which will much aid us in the study, as many of the parts in a natural state are to small to be seen at any distance. By removing a large slice as it were from this I bring into view a large white surface of an oval shape fringed round as it were by the cortical or cineritious substance. This is the Centrum Ovale, or oval Centre of Vieussens, in the

middle of which may be seen two rounded prominences of medullary matter which we shall find to be thin layers of transverse fibres, somewhat harder and more firm than the surrounding parts. It is therefore named the Corpus Callosum, or from the fibres from the two sides interlocking or passing each other it has been Called Commissura Magna, or great commissure of the brain. We shall now proceed to the recent brain, but before I commence, I will call your attention to a brain here which was taken from the subject upon which I demonstrated the Spinal Cord a few days since. We occasionally have, as you all no doubt know by this time, effusions of blood and serum taking place upon the brain, producing paralysis, and otherwise interfering with the functions of the body. This subject was observed to have one arm very full and well developed, whilst that upon the opposite side presented a contrary Condition being shriveled up almost as though it were dried, and upon an examination of the brain, this immense Clot was found upon the side, effused apparently between the dura mater and arachnoid membrane, containing the great mass of matter which you see, and making a large indentation in the side of the organ. This occupied, in accordance with all such cases, the side of the brain opposite to that of the body which had been affected, the result as I shall hereafter have occasion to show you, of a crossing of the fibres from the different sides of the brain, a fact which it is very necessary for you to remember in studying the physiology of the organ. From the appearance of this tumour, it must have existed a long time before death in order to have become so encysted, and to have shown its effects so clearly upon the nutrition of the parts which it governed; the only wonder being how a person could have lived at all with such a compression of this delicate structure and yet it appears that death took place finally from a totally different Cause. I shall now excise a large mass of Cerebral substance from the top of this recent brain, upon both hemispheres, and thereby bring into view this hard commissure or Corpus Callosum and the whole Centrum ovale. Upon one side I have cut through this thin layer of medullary matter and brought into view thereby, the Cavity of one of the lateral ventricles of the brain to which this forms the roof. I next proceed to turn off the layer of pia mater which Covers the face of this Corpus Callosum Seeing by the vessels of which I have told you it was almost

the corp. callosum

composed, to nourish and sustain the medullary matter of which it is composed. You may now more distinctly see the fibrous nature of this body and the direction which these fibres take. This Corpus Callosum is nearly one third of the length of the brain and occupies the middle third nearly, being however somewhat nearer to the anterior than to the posterior part of the organ. As the fibres of which this is composed approach the center although they are continued across it, — they become raised into two lines which have a fissure between them, extending the entire length of the body. This is called the raphé or seam from appearing to join the two sides. I next divide and dissect off the upper wall and you then have a view of the whole length of the ventricle exposed from above, which in this instance is as you see full of fluid amounting to a dropsy of this cavity. There is some fluid always found here which however, in the natural condition does not amount to more than a teaspoonful or two, whenever this it always indicates a diseased condition. This cavity in common with all the others in the organ is ~~filled~~ lined by the arachnoid membrane which being serous in its character, secretes like others of the same nature a kind of halitus or watery vapour, which of course becomes condensed after death, forming the amount of fluid which is normal and which is always present, but such a quantity as we have here it is impossible to account for in the same manner. I next divide along the middle line and proceed to turn off the other side of the Corpus Callosum, and as I do this you see the direct continuity which it has with the Corpus Striatum at its outer edge. It forms a complete roof to the ventricular cavity as it passes over to join that of the opposite side. There are as you will notice two of these ventricles a right and left one, being separated by a very thin partition, semitransparent in character called from this fact the septum lucidum. This runs the whole length from this body which is the fornix to the anterior part of the Corpus Callosum. Of this, from its extreme tenuity it is difficult to get a view but those who are near me can see it when I raise it between the handles of the knives. It is however better seen upon the model as it is there represented larger and more distinct. This partition is composed of two layers, each of which is compound in its nature consisting of a layer of cineritious and one of medullary matter; between these two compound layers exists a cavity or fissure, which constitutes the fifth ventricle of the brain. This is so called not in consequence of its size or situation, but in the order of its discovery, there

existing five ventricles the two large ones which are here exposed being the first and second, the third and fourth being below, and this one between the layers of this thin membrane being the fifth and last. In finishing our study of the Corpus Callosum, we may refer to this enlarged representation where the transverse fibres are well seen; also the manner in which this body turns downwards in front and behind, forming the anterior and posterior knees, bend of the former passing down to the base of the brain and the latter into the posterior lobe; the raphe too is here distinctly seen passing the whole length of the Corpus Callosum. We next divide this partition or septum lucidum through the middle transversely and as I turn back the anterior and posterior parts, I exhibit a beautiful view of the fifth ventricle, which here, from being in health only large enough to admit the blade of a knife, is, from the dropsy which exists here at least a quarter of an inch broad, having as I before explained the two layers of the septum lucidum enclosing it. These layers are believed to be, although nothing is positively known with regard to it ~~to be~~ a vertical commissure for putting the parts at the base of the brain in connexion with those in the upper part by its union with the Corpus Callosum. As we turn off the posterior portion of the corpus callosum and septum lucidum we find that the effused fluid which exists in so great quantity has softened the parts to such a degree as to render them not quite as clear as they are ordinarily, these delicate structures being very easily desarranged. We will now after pouring off the fluid, call your attention to this medullary mass of a triangular shape, which is called the Fornix, which etymologically means a roof, when in fact it appears here as the floor to a part of each lateral ventricle, but after we have ruptured it and removed a part of it we shall find below another cavity namely the third ventricle to which it forms the roof. This fornix is a broad flat body of a triangular shape, presenting its apex in front and base posteriorly being in its centre continuous with the septum lucidum by similarity of structure and substance, and forming by a middle division a part of the floor of each lateral ventricle; If we pass a probe through the posterior part of the fornix downwards it will come immediately into the third ventricle. Upon each of the anterior edges of this fornix we see a kind of red border or

fringe composed of a plexus of blood vessels, filled with a vesicular substance. This is called the plexus choroides and is simply a portion of pia mater in which run vessels veins and a few minute arteries. The fornix at its anterior part, divides into two legs or crura which diverge somewhat after their separation bending downwards to the base of the brain. Upon each side of these crura may be seen an opening which is ordinarily large enough to admit a probe, but in this brain from the dropsy, is much larger. These lead through into the third ventricle and are called the foramen of monroe. We next come to notice the two important bodies which are seen projecting up in the floor of the lateral ventricles. These from the laminated or striated appearance which they present on being cut into, are called Corpora Striatum, being however uniformly ~~white~~ grey or cineritious ~~medullary~~ upon the exposed surface. These bodies present a rounded and somewhat irregular shape being about 1 inch broad at the anterior part, and gradually prolonged posteriorly into a kind of tail; these are continuous in substance with the Corpus Callosum, and in the middle with each other by a white ~~nervy~~ nervous fibre called the anterior commissure of the cerebrum, according to Gall and Spurzheim being supposed by these anatomists to preside over the lower extremities & the function of locomotion. We next notice upon the inside of the prolongation of these Corpora Striata, and seated lower down in the brain, being partly covered by the fornix, two bodies, which present a medullary covering upon the outside but cineritious within. These are the Thalami nervi optici from giving origin to the fibres of the optic nerves, being nearly as large as the Corpora Striatum, but in consequence of their position under the fornix forming only a small part of the floor of the ventricle. In order to see these entirely we must remove a portion of the fornix when they are brought into view as two rounded bodies lying one upon each side and joining in the middle, forming thereby what has been called the commissura mollis or ~~posterior~~ middle commissure of the cerebrum. In dividing and turning back the fornix to expose these bodies we may see the posterior part of this body turning down to be continuous with the posterior knees of the Corpus Callosum, the anterior passing as before mentioned down to the base of the brain. In turning this off we have not as might be supposed brought into view the cavity of the third ventricle, there being still interposed a thin layer of pia mater, continuous with that which we have seen forming the plexus choroides, being stretched in

the angle between these as they go to unite near the foram-en of monroe, This layer of pia mater from being interposed between the fornix and the third ventricle is called the velum interpositum, As I cut up this plexus Choroides and draw it away, you see that I draw out from the substance of these thalami a number of vessels which go to their nutrition, being very vascular as they are very important parts of the brain; between these posterior ganglia of the Cerebrum as they were called by Gall and Spurzheim, you now have a full view of the cavity of the third ventricle covered by the velum interpositum, We notice running in the slight depression between the Thalamus and the Corpus Striatum a long band of fibres called the Tenia Striata or semicircularis, This as it runs in a curved direction dipping anteriorly down to the base of the brain and posteriorly into the posterior lobes is supposed to play a very important part by putting in communication the front and back parts of the organ, in its whole length it forms nearly $\frac{2}{3}$ of a circle, Another small band above which is of little importance is called from the anatomist who first spoke of it, the Tenia Tarini, The union between the two thalami forming the Commissura mollis, leaves a kind of triangular fissure which is the third ventricle, In removing the Corpus Striatum and the Thalamus you see that the white substance upon the outside is but a shell, that in the first we have an alternation of layers of white and cineritious substance until three sets are found; this arrangement is that which I before mentioned as having given the name to this body, The Thalamus consists almost wholly of cineritious substance within having merely scattered fibres of medullary substance intermixed, The union between these bodies has in this instance been broken through by the dropsy which has occurred here, We have next to notice two other commissures in connexion with this third ventricle, You will first notice upon the model this pin which has been divided crossing between the two sides, This is a complete nerve in structure and function probably, having a sheath and composed of medullary fibres, just as a nerve is formed in any part of the body, This is called the anterior Commissure of the brain and serves to put the two sides in communication, which communication must exist, otherwise we

should have the two sides acting as distinct organs and of course interfering with each other, Posteriorly we have a band of these white fibres passing from one side to the other, which is the posterior commissure, The anterior one first described runs between the Corpora Stria-ta and after getting into its substance the fibres diverge in all directions, making a fan shaped expansion thro-ughout this body, putting every part of it in Conjunction with that of the opposite side, In the floor of this third ventricle we have two fissures one anteriorly the other poste-riorly, These were called by the ancient anatomists, who seem to have had some dirty ideas, - the vulva and anus of the brain, From the anterior we have the passage down to a small funnel shaped body, which as we shall hereafter see communicates with a small body called the pituitary gland, This passage is called iter ad infundibulum, or way from the third ventricle to the infundibulum, The posterior opening or anus, passing under the tubercula Quad-rigemina to which I shall have occasion to call your atten-tion, communicates with the fourth ventricle, and is called the iter a tertio ad quartum ventriculum or way from the third to the fourth ventricle, This is also called the aqueduct ~~fossure~~ of sylvius from being first described by that anatomist, When we place the parts of the model tog-ether and remove one of the halves by dividing the fornix in two we have a side view of the parts which we have been considering, First we notice the Corpus Callosum forming the roof for the third ventricle, bending down into the brain posteriorly and anteriorly, - then the cavity of the lateral ~~third~~ ventricle, its very irregular shape and its boundaries, - next the fornix, uniting at its posterior extr-emity with the posterior base of the Corpus Callosum to be extended into the posterior lobes. - dividing anteriorly into its two crura which bend downwards in front of the vulva to the small tubercles which you see at the base of the brain called the eminentia mammilares or albicantia where they terminate, - again, we see the velum interpositum immed-iately under the fornix, and its continuity with the plexus Choroides, and under this the cavity of the third ventricle with its boundaries and outlets, also the Corpora Striata above and the thalami below, - At our next meeting we shall continue with a description of the Cornu of the brain

**Lect. XXII.** In the lecture of yesterday gentlemen, we saw the Corpus Callosum and the roof which it formed for the lateral ventricles of the brain, after which by its removal from both hemispheres we exposed these ventricles, having their floor formed by the fornix posteriorly; the Corpus Striatum at the side and middle, and a small portion of the optic Thalamus inside, we noticed between these ventricles the partition called the septum lucidum, and between its layers we found the fifth ventricle which was clearly seen. Then upon the removal of the fornix after its study, we brought into view the velum interpositum, noticed its continuity with the Plexus Choroides, and its situation as covering the third ventricle, we next saw the two Thalami of the optic nerves, and the larger bodies of a cineritious colour, namely, the Corpora Striata, we saw how these were continued posteriorly, and that between these and the thalami there existed the Tenia semicircularis and Tenia, After noticing the probable value of each of these Tenia, we our attention was attracted to a fissure existing between the two Thalami, which we found to be the third ventricle or ventricle of the Thalamus; we observed in the anterior and posterior part of this ventricle two fissures which lead immediately down to the base of the brain called the vulva and anus, — their connections also being noticed, we also saw the foramen of monro and the openings into the infundibulum, and fourth ventricle, together with the anterior and posterior commissures, I have to day, in the continuation of our study, to call your attention first to the horns or Cornua of the lateral ventricles and their contents, We have already seen that these ventricles are of an extremely irregular shape, having projections or offsets in various directions; these additions or processes are called the horns or Cornua, Of these there are three, namely an anterior, middle, and posterior one, named from their situation,

The anterior ventricle horn, or front one which is represented by the space between the anterior rounded portion of the Corpus Striatum and the anterior knee or projection downwards of the Corpus Callosum, which in fact forms the whole boundary of the ventricle in its continuation downwards both at the sides and ends, This Cornua contains nothing at all which is named, or of any importance

When I speake of the Cavities of the ventricles, you must not be misled by the term to suppose, the existence of an unoccupied space, as these exist nowhere in the body, In speaking of the brain we mean to be understood in the same manner as when speaking of the Abdomen, – as a cavity plenum, or full, the only exception to which is the Collections of fluid sometimes met with, as in this case, separating parts which would otherwise be in Close Contact with each other, Thus it is very necessary that you should remember that in speaking of Cavities any where we mean Cavities filled by the organs or parts with which they bear immediate relation, At the posterior part of the body, for all this middle part consisting of the Corpus Striatum and Thalamus, is called the body of the ventricle, – we find a deep depression, as though made by the end of the finger, This is Called the posterior horn or digital fossa of the ventricle, posterior to this you observe a rising of a long shape extending around this posterior horn; this is the Hippocampus Minor or Ergot, so called from a fancied resemblance to the spur of a cock. Now upon the fresh brain we may see these parts, bringing into view as we turn off the Corpus Callosum the digital depression, with the Hippocampus Minor, and as we open this posterior horn, we find it extending back to an unusual depth, almost to the back part of the brain, there being not more than a quarter of an inch between this cavity and the skull, This extreme thinness of the brain in this direction would lead to important consequences in blows upon this part of the head; and this brings to my mind a very singular case which came into my hands some years since at the Phila^a Hospital, A man was brought there in a state of stupor resulting from some injury of the head. From the history of the case and the slight tumefaction of the integuments, I was induced to believe that the ventricles were distended with fluid causing such a pressure upon the surrounding brain as to deprive the patient of sensation, I trephined this mans head before the Class, just opposite to the tumefied spot over the posterior Corner of one of the lateral ventricles, and found the dura Mater distended outwards by a contained fluid; I punctured this membrane cutting entirely through into the ventricle, and through the opening flowed out a large quantity of pus, By this the man was immediately restored to his senses, and partly to

The human brain weighs the 28th part of the human body;
The brain of a horse is not more than the ~~400~~ four hundredth part of that of his body —

health having been able to walk into the lecture room on two succeeding saturdays, but afterwards from an obstruction to the flow of the pus owing he became worse and died. Upon examination we found that some fungous granulations had sprung out and filled the opening, so as entirely to preclude the flow of matter, and that probably if the knife had been again introduced, the patients life might have been saved. We next enter upon the consideration of the middle Cornu or horn, to get at which we must divide the Corpus Striatum down through, and remove the portion of brain which lies upon its out side, then turn of the Corpus Callosum and we have it exposed. In thus cutting through the Corpus Striatum I have an opportunity to exhibit that radiated arrangement of the Anterior commissure, which I have mentioned as passing through out the Corpus Striatum, and probably, although this is not certainly known, extending in the same way entirely to the external periphery or cortical part of the brain. This middle Cornu, as I now exhibit it, you see runs first outwards and ~~des~~ downwards and then forwards and inward until it comes very near to the base of the brain at the fissure of Sylvius, which you will remember accommodates the lesser wing of the Sphenoid bone, forming the boundary between the Anterior and middle lobes of the brain, - indeed as we shall hereafter find it really communicates with this fissure. In this cornu we have several important points to notice; first we see here an extension of the plexus Choroides after having united from the two sides near the anterior extremity of the fornix, again divide and pass down into this Cornu to be continuous with the pia mater which lines this cavity and, which in its turn is directly continuous with that upon the outside of the brain through the fissure of Sylvius. Thus you see it is impossible to have a general inflammation involving the pia mater on the surface without an extension of it through this and another channel which I shall presently allude to, - to the inner surface or ventricles of the brain. This however does not hold good as regards the arachnoid membrane, for that portion of it which lines the ventricles has no communication whatever with that upon the outer surface of the organ. We next observe

a long and somewhat large body rising at the poster-ior part of the Cornu and running downwards and forw-ards nearly the whole length of the Cavity, being at its end divided by several longitudinal grooves so as to give this end somewhat the resemblance of an animals Claw, This body is called the Hippocampus major, and the extremity from its shape the pes Hippocampi, This body is of no great importance merely constituting a part of the outer wall of the brain, being formed principally by one of the convolutions, Extending upon these Hippocam-pi we have the continuation of the posterior Crura of the fornix which are however of much greater importance, these are called the Tenia Hippocampi or Corpora fimbriata, and form the part of the great commissure of the anterior and posterior parts of the brain, Just inside of these Tenia we have a mass of grey or Cineritious substance having a tooth like appearance, this is called from that circumstance the Corpus denticulatum, You may now see these parts perhaps more clearly upon the model here you have the Hippocampus major, the Corpus fimbr-iatum, and Corpus denticulatum, and here the place of outlet for the continuation of the plexus Choroides to communicate with the pia mater in the fissure of sylvius This large Hippocampus has also been called the Cornu ammonis by the Ancients, because of a resemblance to some of the ~~arms~~ Crest of Jupiter, Ammon We next trace down the passage from the third to the fourth ventricle in our route downwards, towards the base of the brain, and here we shall find many points to be carefully studied, first a small body of Cineritious matter is observed be-hind the junction of the thalami, This is called the Pineal gland, being attached as you see when I raise it up, by two small white bands to the approximate sides of the thalami, these are called the peduncles of the pineal gland by which it is attached to the thalami Now this body is erroneously called, as it is no gland at all, being merely a collection of Cineritious matter having interspersed through it some gritty matter like sand, This is always present in it to a greater or less degree, and there is generally formed one piece larger than the rest which is called the Acervulum Cerebri, This is not distinguishable in the present instance although the gland is nearly

thrice as large as we ordinarily find it, The use of this body is not known; being seated over the passage from the third into the fourth ventricle, the ancients who attached strange ideas to the functions of these parts, conceived it to act the part of a sentinel over this passage, as the pylorus does for the stomach, allowing nothing to pass which was improper, ~~Through~~ At various times there have been various offices attached to it, none however which have appeared reasonable, Descartes for instance finding no other use for it, conceived it to be the seat of the soul, Above the pineal gland and between the two [posterior] lobes we find the lateral fissure of Bichat through which enters the pia mater from the ~~outer~~ [illegible] surface of the ~~brain~~ cerebellum to line some of the interior cavities, This in its entrance envelopes completely the pineal gland between its folds, which afterwards go to the formation of the velum interpositum and plexus choroides, This lateral fissure also communicates with the aqueduct of sylvius, and as it is forced open you may see all these parts distinctly brought to view Before cutting up these parts you may here have a view of the passage from the third to the fourth ventricle, over which you see this pineal gland which is one of the mysteries of Anatomy and Physiology, is seated, Under and supporting this gland is a mass of white matter of a quadrangular shape, divided by a crucial depression into four small bodies or tubercles, these are the tubercula quadrigemina which form the roof of the passage into the fourth ventricle and the bed for the pineal gland these were called by the older anatomists, the ~~posterior~~ anterior two the nates and the posterior the testes, As these are turned up we bring into view the the bridge which passes across from the Cerebellum to the Cerebrum, this is in truth a bridge and is therefore called pons, and was described first by old Varolius and therefore called the pons varolii, Upon the thalamus of the optic nerve we have yet to notice two protuberances one [external] anterior the other [internal] posterior, these have been called the ~~anterior~~ external and ~~posterior~~ internal Corpus geniculatum, We next come to notice the Cerebellum, which we find has an external coating of cineritious covered by the

pia mater precisely as we found the Cerebrum being not like that however in the Convolutions of which it is composed, The substance is here disposed of in lay-ers lying transversely with the organ overlapping each other like the plaits in a ruffle or rather like the leaves of a book, By this arrangement the surface is greatly extended without the occupancy of much space in fact the Cerebellum although much inferior in size to the Cerebrum, if unfolded entirely would not be a great deal less, the Cerebrum if unfolded would measure in diameter about two feet, whilst the Cerebellum if managed in the same way would meas-ure about 20 inches, This gives great amplitude to this part of the organ, and of course extends its functions, Upon the middle line of the upper surface we have a projection which, from resembling in the ridges which form it the back of an earth worm, is called the vermiformis cerebelli, and upon each side of this we have a pinnacle which is higher than any other part of the organ and is called the monticulus cerebelli, When we invert the organ we find a depression in it and also find an inferior vermis. These points being primary in the mode of development, were considered by Gall and Spurzheim to be the most important in function to animal life, in fact the fundamental parts of the ~~brain~~ ; ~~their counterparts being found in~~ ~~all animals. even when we decend to the zero of the~~ ~~scale of animal life~~, Now as we turn down this mon-ticulus and make a division in the middle line of the Cerebellum we separate the two lobes of which it is composed and expose another Cavity which is the fourth ventricle, This lies before the Cerebellum and above the spinal marrow, and would be open if it were not for a thickening of the arachnoid which you see is here very different from what we have seen it in other places, being quite firm and strong, this then forms the floor of the fourth ventricle and shuts it up completely, I know that Magendie denies this and says that it communicates directly with the Spinal Cord, but I ~~know that it does not, hav-~~ ~~ing observed it over and over again~~, At times it is true when water accumulates in the ventricles it at

first softens, but finally succeeds in getting through this membrane onto the surface of the brain. Many of you will remember a case which I brought before you a year ago, in which such distension of the ventricles had occurred and the fluid had finally softened this membrane and got upon the surface of the brain increasing the size of the head to an enormous degree, two or three times the natural size. The child as you will remember was brought here in a state of stupid unconsciousness, but as soon as the trochar was pushed into the sac, and the tension relieved by the discharge of the water, the childs consciousness returned and it shortly after, took the mothers breast which it had not done for some time. This however afforded as was anticipated only a temporary relief, the child dying a short time afterwards. Into this fourth ventricle runs the passage of which we have now to speak. Running down from the tubercula Quadrigemina, you perceive a layer of medullary matter passing down to the cerebellum, this thin lamina closes the passage above and is called the valve of vieussens, from the fact that in slicing down the brain as it was formerly only demonstrated, the tubercula Quadrigemina were cut off and this played backwards and forwards as a valve. As I pass a probe through this Iter e tertio ad quartum ventriculum you see this is almost transparent so thin is it. This thin part is the valve of Vieussens or velum med. Forming the sides of this passage we find the processus e cerebello ad testes. These however do not stop at the testes but go on to expand throughout the cerebrum forming a part of the great commissure between the cerebrum and cerebellum, being continuous in the latter organ upon the sides, where it gives origin to the roots of some of the most important nerves as the auditory and pneumogastric nerves, hence in these inflammatory affections of the brain in children, they upon the effusion into the ventricles taking place are apparently much relieved, and the friends and even the physician may be flattering himself with hopes of a cure; but these are always suspicious calms, for when the water makes pressure upon the roots of these nerves their function is interfered with and the patient dies from disturbance of respiration

**Lect. XXIII.** It has been with much regret, gentlemen, that I have from indisposition been compelled to absent myself for a few days, causing a temporary suspension of my lectures. You will remember that at our last meeting we had finished the demonstration of the Cerebrum in the old way of Vieussens and Willis, and had after viewing the passage from the third ventricle, arrived at the Cerebellum, where we were engaged in an examination of the fourth ventricle which we found within the latter organ, whence it is sometimes called the ventricle of the Cerebellum. Into these parts we have now to enquire more minutely previous to an examination of the inferior surface of the Brain. When I remove upon this model, the Cerebellum from the Cerebrum, you see that it is by a transverse section through this white body which is the Pons varolii, dividing also the Channel of Communication which we have found to exist between the third and fourth ventricles. This you will remember is the iter e tertio ad quartum ventriculum ~~and~~ which is one of the passages through which fluids reach the base of the Brain, thus we find that accumulations of fluid in the lateral or upper ventricles enter the third ventricles through the foramen of monroe, and thence through this passage into the fourth ventricle where they are confined until some rupture takes place in the membranes. We found moreover that the top of this passage, or roof, was formed in part by the tubercula quadrigemina, or nates and testes. I now wish to call your attention more minutely to this ventricle, into which we have now arrived. This is sometimes called the Sinus Quadratus from its quadrangular or lozenge shape which you may notice upon this section of the model. We find that this valve of Vieussens which we before described as forming the roof of the passage between the ventricles, forms also a part of the roof of this ventricle from its continuous connexion with the Cerebellum, forming a communication between it and the testes. We next notice that this ventricle is not closed up at the bottom by medullary or cineritious substance, but in the model presents an open communication with the outside of the brain and spinal marrow. Now this is owing to the absence of the membranes, for when these exist in a normal condition there is no opening here as you may see upon this entire brain. The arachnoid membrane is here, three or four times its usual thickness and is some

As there is a distinct arachnoid membrane for the ventricles

-what more opaque in this specimen, than natural, - and is extended entirely across and around this opening, forming a perfect floor to the ventricle, shutting off all communication from the sheath of the Spinal Cord, as well as the outside of the Brain, In extensive collections of fluid here, however, this membrane becomes distended and finally ruptures, allowing the contents to flow better ~~into the theca of the cord and~~ between the ~~arachnoid~~ pia matter tunics of the exterior of the Brain, producing those dropsies so difficult to remedy and so fatal in their consequences. We have also seen the fundamental portions of the Cerebellum the superior and inferior vermes, the monticulus, and the manner in which the quantity of cortical substance is increased in extent, not by convolutions like the intestines of a Child but in plaits overlapping each other like the leaves of a book, And again before we place it back we notice again this pons or bridge by which the Cerebrum communicates with the medulla Oblongata and Cerebellum. We find the upper part of the Spinal marrow has a greater diameter when it joins the pons, and this portion as low down as we can reach in our separating incision inside the Cranium is called the Medulla Oblongata, This is not a very well defined portion of the Spinal marrow, for as you may perceive the line of division is an entirely artificial one, the one part being a direct continuation of the other or lower without the possibility of a distinctive difference, The upper termination of the Medulla Oblongata is not in the Pons as you might be lead to suppose by the appearance of this part of the brain, but its fibres are continued up through this bridge, through the Crura of the Cerebrum and through the Corpora Striatum probably to the peripheral or cortical part of the brain, This as we shall see when we come to regard the brain according to its functions, is the proper termination of the Spinal marrow, and the only one which should be considered at all, the others as regarded heretofore based upon the external appearances, being entirely artificial, and not calculated to promote a clear understanding of the functions of the organ, If we consider that part of the Cord as medulla Oblongata which exists inside of the Cranium, it will be

As there is a distinct arachnoid membrane for the ventricles it must form in the healthy state a closed sac for the bottom of the 4th ventricle, over which the external arachnoid passes - the There is opening formerly in Hydrocephalus

Constantly varying with the motions of the head, as when we bend it forward, we draw up more of the cord than exists there in the erect attitude from the fact of the Condyles being situated upon the anterior part of the foramen magnum. I have here a cerebellum split open in the median line, showing the relative situation and connexions of the pons, and the cavity of the fourth ventricle. We may notice running along the upper part of this ventricle upon the pons, and medulla oblongata a vertical groove which is a continuation of the posterior groove which we found running the whole length of the Spinal Marrow and called the posterior median fissure. Upon each side of this fissure, upon the medulla oblongata you see two long rounded, cord like bodies which are called Corpora restiformia, these diverge from each other at the top of the medulla oblongata where the fissure continues upon the pons, and this divergence with the fissure in the centre ~~from~~ somewhat resembling the nib of a pen has been called the Calamus Scriptorius. In this part of the nib of the pen we see a number of white stria radiating on each side, these are originating fibres of the proper auditory nerve which afterwards are collected into the portio mollis of the seventh pair which we shall hereafter notice. Now this origin is very interesting as accounting for a number of cases of deafness which are met with, which doubtless arise from the pressure of fluid in this ventricle upon these fibres. It is easy to perceive how those cases of congenital deafness are produced by a dropsy here and how likely they are to be followed by a general hydrocephalus from the escape of the water by rupture of the floor of the ventricle before noticed. We have next to observe that upon the front of the medulla oblongata we have a split or groove which is a continuation of the anterior median fissure of the Spinal marrow; immediately upon each side of this you see a long body of a pyramidal shape which are called the Corpora pyramidalia, on the outside of each of which are two bodies of a somewhat olive shape which are the Corpora Olivaria, and then upon the outer or posterior side of these again we have the Corpora Restiformia already noticed, these three bodies occupying the whole semicircumference of the medulla. Now when we attempt to separate

these Corpora Pyramidalia in the anterior median fissure we find ourselves resisted by a Crossing of fibres, and upon examination find that nearly the whole of the fibres Composing each pyramid, or at least $\frac{2}{3}$ of them Cross onto the opposite side of the Spinal Cord. So that these bodies which are the main points of Connection between the anterior portion of the Spinal marrow and brain put the right side of the one in Communication with the opposite one of the other, thereby directing us in our examinations for the Cause of a paralysis of one side of the body, to the opposite side of the brain, We observe here upon the model as well as upon the brain, that the divisions are kept up perfectly upon the medulla Oblongata as we found them upon the Spinal marrow. where you will remember that we found each lateral half of the Column divided into two tracts a posterior one for sensation and an anterior one for motion, you will remember too that I told you in regard to the exact line of separation between the two, that it could not be pointed out, and we were therefore obliged to consider the middle of the intervening space as the division, having a tract behind the origin of the sensorial nerves, called the posterior sensorial, and one before them Called the antero lateral sensorial tract, and so also with the nerves of Motion, Now we have precisely the same functional division in the Medulla Oblongata, and this model has been divided in the line where this separation of function is supposed to exist, for it cannot be absolutely demonstrated, and we see the line of separation falls behind the Corpora olivaria, throwing these and the Corpora pyramidalia into the anterior or motor tract, and the Corpora restiformia into the posterior or sensorial tract, which as we shall see when we Come to examine them from below separately perfectly accords with their functions, where we shall find that Certain of them have nothing at all to do with the Cerebrum and others nothing at all with the Cerebellum, a physiological fact of much importance in the study of these parts. We now having studied sufficiently these parts for the Present, Come to take a view of the base of the brain, and here

we may notice that in removing the brain from the skull we are unable to make it present its natural appearance owing to the manner in which it must be done, the medulla will always bear a sloping direction which is not natural and has been avoided in the model where you have a correct view of the normal situation of the parts. We find to notice first upon the lower surface the general convoluted condition of the exterior of the organ, and in the anterior part a large deep fissure which marks the dividing line between the anterior and middle lobes. This is the fissure of Sylvius which as we have before seen accommodates the lesser wings of the sphenoid bone. The division of the middle from the posterior lobes is however by no means so distinct having no line at all in the brain, merely marked by the superior angle of the petrous portion of the temporal bone, hence some anatomists describe these together as the posterior lobe, and notice no middle one. We have then another large transverse fissure separating the cerebrum from the cerebellum, which is occupied by the tentorium upon which the posterior lobes of the cerebrum rest. We notice here that the pons which is surrounded by the tentorium, is extended back upon each side into the cerebellum by what are called the peduncles or crura of the cerebellum, having extensions also into the cerebrum called the crura cerebri, If we should cut off these four points, we would detach the pons entirely from these organs leaving it only in connexion with the spinal cord below. We next observe a deep fissure which divides the two hemispheres from each other, lodging the falx cerebri and longitudinal sinus, This does not extend entirely to the pons, and between its termination and that body we have several important points to draw our attention, First this exceedingly delicate but very important nerve extending upon each side, These constitute the olfactory or first pair, and have as you see a kind of bulb upon the extremity, This bulb is largely developed in animals which have the sense of smell highly developed sometimes even containing a ventricle within it. These have their origin as you see by three roots, some of which can be traced through the mass of grey matter to the corpus striatum, which as we know is connected by continuity of fibres with the spinal marrow, and

hence there exists a connexion between these nerves and the Spinal Cord. Upon the model these nerves are raised so as to exhibit them more clearly, but on the brain you see they are imbedded between two convolutions. We next notice coming out from the brain apparently, at the sides and upper part of the pons, the second pair or Optic nerves. These meet after having proceeded a short distance and at this meeting an exchange of a great number of the composing fibres takes place. This is called the Chiasm or crossing of the optic nerves and takes place upon the sphenoid bone anterior to the sella turcica. In some animals all the fibres of these nerves cross, so that the eye of one side is completely supplied from the opposite side of the brain. These originate from the Thalami of the optic nerves and the nates of the tubercula quadrigemina, and run round the Crura Cerebri of either side as you see upon this dissection. When I raise these up at their Chiasm or crossing, you see I tear away a mass of grey matter, fibres of which you may yet see running across from side to side. This is the bottom or lower part of the third ventricle and prevents fluid from issuing upon the base of the brain it is called the tuber cinerii or pons tarini. You here have also a very good view of the peg passing from one side of the cerebrum to the other to which I before called your attention as the anterior commissure of the cerebrum. When I turn down these nerves again you see lying between them and upon a part of this pons tarini, a funnel shaped body which is the Infundibulum. This is in reality a funnel except that the point is closed up. This point is in connexion with a small body which occupies the sella turcica of the sphenoid bone, called the Pituitary Gland from the ancients supposing that it secreted the pituita which is discharged through the nostrils in a common catarrh. We however now know that it is no gland at all, but a simple body consisting of a cineritious and medullary substance closely invested by the membranes of the brain, and although probably playing an important part we do not know what that is. — From being often found diseased after epilepsy, it has been supposed to be in some way

concerned in its production, but this is mere surmise and not at all probable, It is situated as before noticed upon the sphenoid bone and surrounded by the cavernous sinus Behind this body we have two small eminences which from their round or nipple shape have been called the pisiform eminences or eminentia mamillares, These have been before noticed as terminating the anterior decending crura of the fornix, and hence sometimes called bulbi fornicis, Upon the outside of these parts we have to notice a portion of the surface which is perforated by an immense number of vessels from the pia mater, this is immediately beneath the corpus striatum which being composed principally of grey substance must necessarily be very well supplied with blood vessels, as upon this fluid the nervous power appears to depend for its development. This is called the Substantia perforata, or locus perforatus anterior a name of no great importance to remember, Immediately behind these eminentia mamillares we have a small plane or surface also perforated by numerous vessels to supply the Thalami within, This forms a part of the floor of the third ventricle and is called the locus perforatus posterior, below Above and behind this we have coming out the third pair or Motor oculi, these come out from the edges of the crura cerebri and go to supply all the muscles of the eye except the ~~superior~~ external rectus and the superior oblique, We next have these exceedingly delicate filaments, looking like a strain of sewing silk, coming from an origin in the valve of the brain and winding around the crura cerebri. These are the fourth pair, pathetici or trochlear nerves from their supplying the superior oblique or trochlearis muscle which was supposed to give a pathetic expression to the eye, We next have the fifth pair coming abruptly out of the body of the pons but not originating there except in small part, they arise by two roots, one large the other small, principally from the corpora restiformia, some fibres from the pons, and therefore belong principally to the posterior or sensitive tract of the spinal marrow, The nerve is made up of a great many bundles of fasciculi, which in their turn are again composed of an infinitude of minute nervous fibres, This from dividing into three principal branches has sometimes been called the trigeminus, We next arrive at the sixth pair which from arising principally

from the Corpora Pyramidalia at the top of the Pons we might judge to be motor in function, These go to supply the external rectus muscles of the eye, Next we have the seventh pair, which from consisting of two parts distinct in function as well as character, modern anatomists have described as two pair seventh and eighth, These as noticed are made up of two portions, one soft called portia mollis which is the proper auditory nerve, — the other hard and called portia dura or facial nerve, which ~~is distributed~~ passes through the temporal bone, out at the Stylo. mast. foramen to give motion to the face, These apparently come out at the place of junction between the medulla oblongata and pons, but have their origin in the first, — the true auditory from the mass of cineritious substance before noticed in the fourth ventricle near the Corpora restiformia; — the facial from the motor tract, with some fibres from the pons, The eighth pair consists of three distinct nerves, — the first or smallest of which comes out at the back of the Corpus olivare and goes to be distributed to the tongue and pharynx being the Glosso pharyngeal, The second of the eighth pair is the Pneumogastric which comes from the Corpus olivare which is a mere ganglionic mass interposed between the Corpus pyramidale and restiforme being rather sensorial than motor although in this part of the tract, it seems in some animals to be developed here for the purpose of giving origin to the par vagum and is probably distinct in the same way in man forming no part of the spinal marrow although in connexion with it, The Spinal accessory of Willis or third branch of the eighth pair comes off by many roots from the spinal marrow, some as low down as the fourth and fifth cervical vertebra, proceeding upwards it enters the cranium by the foramen magnum and is thence distributed through the foramen lacerum Jugular foramen to the sterno cleido mastoid and trapezius muscles principally, This is exclusively a nerve of motion, coming off from the anterior tract of the spinal marrow and also getting some filaments from the medulla oblongata, Tomorrow, as we have now finished the cursory demonstration downwards, we shall commence to pay some attention to the parts in their functional order, as we had intended,

Lect. XXIV.

I now wish gentlemen after having given you a view of the complicated structure of the brain from above downwards, to view it in regards to its functions and development, the first however I have given a sketch of, as we proceeded with the description of the various parts in their order. We shall therefore to day concern ourselves in building up the brain from below, in the order of its development, as well as function. This mode of demonstration was first proposed and adopted by the celebrated anatomists Gall and Spurzheim, who by teaching the anatomy in this manner have best succeeded in fixing the real value upon the various parts and the part which they subserve in the economy, making the examination a physiological at the same time that it is an anatomical one, and therefore being best calculated to a clear understanding and retention of the various relations of the organ. We may recollect that the Spinal marrow was considered as consisting of two tracts upon each side separated by the great median fissure that each of these halves consisted of two tracts, the one sensation the other motional, each giving rise to the nerves appropriate of these distinct offices. That the line of distinction between those tracts was not clearly defined but was supposed to exist midway between the roots of the nerves. Now if we carry out this functional division into the brain we must see that there are different parts of this organ devoted to the different offices, with the superaddition of something more for the perfection of or maturation of the impressions received, and the reaction which they do exert upon the economy. To view the brain then as a prolongation of the spinal marrow in function, with the addition of an apparatus for intellection, is to simplify its study to a great degree. Now we notice that the separation of the functional parts of the spinal marrow as it progresses into the brain, takes place in the Pons Varolii, - the sensorial tracts with a small number of motor fibres, proceeding through the Corpora Restiformia into the Cerebellum, and the remainder or motor tract proceeding up through the Crura Cerebri into the Cerebrum through the various ganglia which we shall have to notice. Upon this brain which has been rendered tough

and hard at the same time that it remains pliable, I shall be able to demonstrate to you three different appertainments of the fibres of the Spinal Cord, In this you see the Cerebellum has been divided into its lobes through the median line so as to enable us to expose the top of the pons and fourth ventricle, Here you may perceive the whole of the Corpora restiformia and notice the manner in which from constituting a portion of the anterior or sensitive tract of the Medulla Oblongata, they separate leaving the Cineritious substance to become exposed to form the Cineritious mass which we have found in the fourth ventricle and going to form the tuber cinereum, In this separation of the two Corpora restiformia you notice one going to either side and expanding or becoming larger as they go to participate in the formation of the Crura Cerebelli- This exposed Cineritious mass at the top of the Spinal Column is the substance from which the whole Cerebrum is developed, and its augmentation in size over that of the Cerebellum is the distinctive characteristic of the brain of man over the animals as it is in this portion that they are deficient, The increase in the size of the Corpora Restiformia as it diverges backwards into the Cerebellum, is due to the interposition in their substance of a mass of Cineritious substance, from which start out an innumerable quantity of medullary fibres in all directions, these we know to be always consequent upon the existence of this grey substance wherever placed, for its function is that of eliminating nervous influence, and this must have medullary fibres for its transmission, This mass is the ganglion from which is developed the whole Cerebellum and constitutes the Corpus dentatum from which the thousands of white fibres are radiated to form the organ, Having now called your attention to this mass or Corpus dentatum, we may examine into the mode of growth of this Cerebellum, If we commence at the Medulla oblongata we shall see that in the separation of the Corpora Restiformia from this body, and of the remainder of the Crura Cerebelli from the pons there must be space left between which is the f

ventricle, which like all the rest of these cavities is a mere accident occurring from the peculiar arrangement of the surrounding parts, In this branching out of the white or medullary matter from the Medulla Oblongata, we have formed the trunk of the tree which is called the arbor vitæ, which trunk dividing into branches which in their turn divide until we come finally to the leaflets of white substance which fills out the tree like arrangement. This trunk contains within its fibres the fourth ventricle, a part of it forming the valve of vieussens and the processus e cerebello ad testis the two of which this valve serves to connect at the top, another portion forms the corpora restiformia as before noticed, and a third part is spread across the pons forming the great commissure of the Cerebellum, I have shown you upon the black board, a diagram by which you may form some idea of the formation of these parts, The branches from this trunk shoot out in all directions forming twigs and leaflets, and these all consist of the medullary or white matter, for with the exception of the corpus dentatum there is no cineritious substance in the cerebellum, On the surface however, surrounding every twig and leaflet, and dipping into the folds between you perceive the covering of cineritious completely enclosing the whole arrangement and forming these plaits or overlappings which we have before noticed, Now the object of this covering will be evident when we take into consideration the function of these parts, for instance we have seen that the function is that of receiving sensation which is carried up the spinal cord by the sensory filaments of medullary substance, which if existing here alone could take no cognizance of the sensation as their office is only to transmit it, but by having a covering of cineritious matter this becomes appreciated and taken cognizance of, being sent for maturation and for the action of volition to the cere~~bellum~~brum as we shall hereafter see. You see I have represented upon the board seven of these deep fissures upon the cerebellum into which this cineritious coating must pass, and this is just the number which we find in the organ, Before the received impressions of sensation can be acted upon, we must have some means of communication with the

cerebrum which we know is the intellectual part of the organ, and therefore that in which deductions and reasonings are made. This is accomplished by means of the Processus e Cerebello ad testes and the valve which connects them together. This is the Commissure between the cerebrum and Cerebellum, being composed of medullary fibres this transmits the impressions to the Cerebrum where they become perfected and acted upon to the requisite extent. There is also an evident necessity for some communication or commissure between the two hemispheres of the Cerebellum to ensure a harmonious action between the parts. This is accomplished by the transverse fibres upon the lower surface of the pons, constituting a part of what is called the Crus Cerebelli. You will observe here how this great Commissure from the Cerebellum to the Cerebrum runs up to form the the ~~testes~~ and thence into the optic thalami which are the posterior Ganglia of the Cerebrum, communicating in their turn with the anterior ganglia or Corpora striata and thence through the great Commissure or Corpus Callosum. We notice again that the fibres which form the commissure between the lobes of the cerebellum, are transverse passing from side to side. These constitute the true bridge or Pons of old Varolius, under which pass the fibres of the corpus pyramidalia and olivaria in their ascent to the cerebrum, just as a river passes under a bridge. The name is applied now however to the whole mass rather than to this commissure. I next call your attention to the fibres of the Corpus pyramidalia and those of the Corpus olivare going up in distinct bundles to the cerebrum through the Crura, and also to the Commissure between the Corpora pyramidalia and corpora restiformia, which from their bow shape have been called the arciforme fibres. These two masses go up to the Corpora striata and enclose within them some grey matter from which new fibres constantly grow.

The remainder of this lecture

absent on account of loss of the notes.

1871. Dr Robt. McDonald has presented to Royal Irish Academy, a new theory of nervous action (Neuricity) - He considers that the peripheral expansion of nervous fibres, take up undulations or vibrations, convert them into waves, & propogate them along the nervous tissues - the waves may differ in character in length of undulations - one wave that may represent simple contact - another heat - vision, an undulation of one kind, may be made by a [illegible] another & [illegible] - it is supported by an [illegible]

**Lect. XXV.** Having shown to you and spoken at some length upon the Great Centres of the nervous system, whose divisions and subdivisions of Nerves ramify throughout the entire economy, I have next to speak of the Great Centres of the Circulatory System whose branchings are likewise found throughout the body and whose functions are in like manner essential to existence. The Central organ of this great and important arrangement is the

## Heart

Which is situated in the Cavity of the thorax, near the centre, but inclined somewhat to the left side occupying

Situation

an oblique situation rather than vertical the base being upward and to the right, whilst the apex looks to the left. It lies invested in its membranes between the lungs of the two sides, the external layer of the pleura, as we saw last evening, giving a covering to its investments. We have in Man two distinct and separate hearts in

2 hearts

function ~~entirely~~ almost independent of each other, - the one concerned in the Circulation of Black Blood called the ~~Left~~ heart, and one of red blood called the left heart. These for the purpose of economizing space as well as to render the arrangement more compact, are situated in conjunction with each other; and form the entire mass known as the heart in common parlance. This entire independence of each other only holds good in the adult condition, for in Foetal existence there is a communication between the two upper cavities, to subserve purposes to be hereafter noticed. I hold in my hand

models

Models taken in wax, of the Cavities of the heart, and you see by the different colour, and the entire disconnexion of the two, how exclusive the division is, no communication whatever having existed. Each half, or heart is divided into two cavities, which however do communicate with each other, as you see that the injected wax has passed into both making one solid cast with a narrowed or constricted part near the middle. The lower of these cavities are called ventricles, and go, particularly that of the left side to form the apex or point of the heart. The upper two are found to constitute the base, and have been called ~~ventricles~~ Auricles, from the shape of their appendages somewhat resembling a dogs ear.

he quantity of water which blood contains is said to amount to almost seven eighths of the bulk

Thus we have the whole of this double organ presenting the shape of a Cone, whose base consisting of the auricles is presented somewhat obliquely upwards.

cone

The communication between the auricle and ventricle through which you see the wax has passed to form the continuous cast are called the auriculo ventricular openings for the passage of the blood in its route.

Upon the subject we have here the heart and viscera in their natural situation and you observe that it occupies a position almost immediately behind the Sternum, and between the reflections of the Costal Pleura of each lung, having the inclination before noticed. The size of this organ has been compared by Laennec to that of the closed hand but this is very imperfect guide, as in a broad shouldered well developed individual it is always much larger than in one with a narrow chest depending rather upon this than upon stature.

hand

chest

The base of the organ is situated some distance below the top of the Sternum and the apex reaches the space below the sixth rib of the left side. When you open the chest by removing the sternum the heart is entirely hidden from view being enveloped in its proper membrane, the pericardium, and when an attempt is made to draw it out from its position there is resistance made by the attachments of this membrane to the vessels above and the diaphragm below. The pericardium envelopes somewhat loosely the heart and can be traced up, forming tubular sheaths around the great vessels as they leave the organ, being degenerated gradually into the fibrous coats of these vessels, and therefore inseparable, - below it is attached by dense cellular tissue to the cordiform tendon of the diaphragm, from which it may be dissected, showing its entire purse like form by which the heart is enclosed. Within the cavity of this membrane collections of fluid sometimes take place, forming that species of dropsy, known as Hydrops pericardium. This membrane is of a fibrous character like the periosteum and dura mater, is of great strength and density and is partly cover-

the outer surface by the pleura, As I split open this fibrous enclosure you can see in what manner it encircles all the great vessels in a tubular ~~man~~ prolongation, and you also perceive that it has a very smooth polished surface This it derives from the presence of a serous lining membrane precisely analogous to that found in the joints peritoneum pleura ~~&c~~. placed here for the purpose of diminishing friction by the fluid which it secretes. This does not only line the inner face of the fibrous pericardium but is reflected after the manner of these structures in general, over the heart giving it a bright glossy coating, and forming the shut serous sack. The fibrous pericardium with its serous lining in terminating above around the vessels form by their reflections from one to the other a number of pouches which have been denominated the cornua of the pericardium, I next wish to direct your attention to the vascularity of the heart, for although employed in the circulation of the blood through it, it is by no means nourished by the fluid thus received into its cavity, having of necessity a peculiar vascularity of its own by which its condition is maintained, It consists of a hollow muscle, and like all muscles must receive a plentiful supply of arterial blood in order that its functional organization may be maintained, This is accomplished by means of two large arteries sent off from the great aorta immediately after it leaves the heart, These vessels go off one upon either side of the organ, completely surrounding it, and hence are called Coronary Arteries, They are as you may see quite large vessels, and distributed to the muscular structure, but particularly how, I shall not take up your time in describing as it is of no practical importance, In case of arrest in this circulation there is no doubt but that the heart would be as truly asphyxiated, as though it were not concerned in the transmission of blood, that in the cavities being insufficient to the proper stimulus of the organ, or not being in the proper place to afford that stimulus Now with regard to the functions of these separate hearts in the circulation of the blood, we find that each one has its appropriate allotted task to perform, The right heart being engaged in sending the black blood to the lungs for regeneration after which it becomes red and is returned

to the opposite heart, which in its turn is occupied with sending the red blood through the tissues of the body, in which route it is again converted into black or venous blood and returned to the point whence it started, Now you perceive here are two perfect Circulations, two Circles as it were, and these are named the first or that belonging to the right heart, the lesser or pulmonic Circulation, and the other or that of the left side, the greater or Systemic Circulation, the one converting black into red, the other red into black blood. After having passed from the left side of the organ and been distributed over the body, and in the performance of its function been changed into venous blood, that of the lower extremities and abdomen by the illiac and portal veins is collected into a large vessel, called the vena cava inferior or ascending cava, which after perforating the diaphragm goes to empty its self into the right auricle, That of the upper extremities and

Circulation head and neck is collected upon the left side by the emptying of the internal and external jugular veins into the subclavian, forming the Transverse vein, - and upon the right by the formation of the vena innominata, the coalescence of which two form the superior or descending vena cava which goes also to empty into the right auricle. I shall now by opening these venæ Cavæ expose the right auricle upon its internal surface, keeping the heart still within the body in order to give you a better and more impressive idea of its relations, and position, although at some inconvenience from the blood which is always formed in these vessels, being some what troublesome, In exposing the cavity of the auricle you notice that the two Cavæ run together and form a part as it were of this cavity, Now as I pass the knife handle down inside the ascending Cavæ through the diaphragm and notch in the liver, you perceive that the direction is not that of the descending vessel, but that it forms with it an obtuse angle, The utility of this arrangement is at once apparent when we reflect what would be the consequences of two such columns of fluid coming together from precisely opposite directions, in a case

a particular direction of the united fluid was necessary
the effect of course would be to deaden both currents
and produce a great tendency to rebound, But in the
arrangement which here obtains where the vessels are
both directed slightly inwards, the effect is that
of promoting the flow into the cavities without any
tendency to rebound or congestion of the vessels below.
This opening of the two vessels produces an expansion here
Sinus of the vena cavæ known as the Sinus of the vena cavæ, but which is in
reality a part of the auricle, Immediately at the junction
of the two outer walls of the vessels, we have a fleshy pro
-tuberance which is the apex of the angle, This is the
tubercle of Lower from the anatomist Lower who carefully
studied and described these parts, This tubercle exists
to a much greater extent ~~ent~~ in the bullock and many
other animals, making in man a mere ridge or elevation
We have another large vein discharging its blood into
this auricle slightly to the inner side of the ascending
cava, This is called the coronary vein and comes from
the heart to ~~em~~pty by quite a large opening, a quarter
of an inch at least in diameter, This is the foramen
of Thebesius, and is furnished with a valve by which
a reflow of blood is prevented during the contractions
of the auricles, This is the valve of Thebesius from the
anatomist who discovered it, There also exist many
small orifices by which blood is poured into the aur
-icle from the substance of the heart, some of which are
here perceptible, We observe upon the preparation a
slight fold of membrane extending round a sort of
oval depression at this part of the auricle, This is
valve of Eustachius the remains of the valve of Eustachius which in the
foetal state served to conduct the mass of blood
through an opening then existing called the foramen
ovale, which communicated with the right auricle
This is rarely found open in adult life the only
trace left of it being this depression called the fossa
Fossa ovalis ovalis, By the existence of this opening in foetal life
the current of blood was ~~+~~ diverted from the lungs
which of course could then subserve no purpose of
aerating the fluid, After their expansion in respiration
then this foramen is generally closed by the adhesion
valve of Botale of the valve of Botale which serves that purpose, + is seen in the [illegible] in the left auricle Upon the

beautiful wax model which I have lately obtained from France, you will be able to see these parts more clearly. In the opening of the right auricle here you have exposed the whole of this arrangement the tubercle, the valve of Eustachius, the fossa or depression which corresponds to the foramen ovale of the foetus, surrounded by the annulus ovalis or oval ring, with the vertical valve of Botal by which it is closed. You see also in this specimen the nature and size of the opening which leads into the ventricle of the same side. We next notice the smoothness and polish of the inner walls of this auricle, which is due to the lining membrane, which is a somewhat modified serous tissue, evincing some of the characteristics of a mucous membrane and hence denominated by Bichat, the common sero mucous membrane. This lines as well, all the veins, but is here called the endocardium; It is exceedingly liable in the left but not the right cavities of the heart to inflammation and its consequences, which is denominated endocarditis. This inside, or endocardial lining is extremely thin and delicate, being like serous membranes, transparent. Between this endocardium and the outside layer of serous membrane we have the muscular fibres of the auricle placed. By holding it up to the light it will be seen that these fasciculi somewhat resemble the teeth of a comb and have hence been called musculi pectinati. The interstices between these fasciculi are diaphanous owing to the thinness of the membranes, and the want of any considerable quantity of muscular. This as the auricle does not contract strongly, is not as might be supposed, an inordinate want of strength.
As I raise or lay off this auricle you perceive the opening into the ventricle. this is called the ostium venosum or right auriculo ventricular opening (ostium venosum). In this ventricle we find a continuation of the lining membrane of the auricle, arranged around its different parts. But in contractions of this cavity, what prevents a reflux (reflux) of the blood into the auricle? We find here that be going through from one cavity to the other the lining membrane is reflected from the edges of the orifice and dr

upon itself in returning, in such a manner as to form three angular or pointed folds whose bases surround completely the opening, these folds have an interposition of some fibrous tissue between them, and are called the Tricuspid or three pointed valves; These close or very nearly so, the whole opening, which is their office during the contractions of the ventricles. But if they existed here free from any connections the force of the ventricle in contracting would push them through into the auricle, and admit of a regurgitation which would produce pulsation in all the neighbouring veins as we have in the arteries, and a very limited quantity would pass into the smaller opening of the pulmonary artery. To prevent this we have in the ventricle whose parietes are much thicker than those of the auricle, a number of fleshy or muscular elevations or columns arising all around the cavity, these are the Columnæ Carneæ, and to their points are attached cords whose opposite extremities are fixed in the free margins of the valves. These are called Cordæ Tendineæ, and by their connexion effectually prevent the pushing of the valves beyond the plane of the opening during the contractions. Thus we have formed perfect flood gates, which open with facility to permit an inward flow, but are forced to, by any reflux. These being of yielding material there was a necessity for a means of fixing them, and this is accomplished by the musculæ Carneæ and Cordæ tendineæ, which act precisely as stays. These arrangements are shown to more advantage upon the heart of a bullock which I have here, and you see that by my hand I can almost close this valve so as to obturate the opening. These valves never wholly close the opening even in perfect health some blood regurgitates but not to a great amount. Positive perfection here not being required, and you may see that it is impossible to push the valves through beyond the level of the opening even in the present flaccid condition of the heart, and it should be remembered that in the contractions which take place these columns must contract also to counteract the shortening of the cavity, for if the cords were of the same length during the contractions they would evidently suffer the valves to project into the auricle at such times from a diminution of the cavity or an approximation of the fixed points of attachment.

pulsation if no attachment of valves –

flood gates

columnea carn contract

We next have to notice the Pulmonary artery, through which the blood is forced during the contractions of the ventricle. Now this is not called an artery from the quality of the blood which it carries, for on the contrary it always conveys venous blood, but as all vessels which carry blood from the heart have been so denominated, this does not vary from the rule although in the office of carrying black blood it is truly venous. It also has the construction of an artery rather than of a vein and this is another reason for calling it so, and it is called pulmonary because it transmits blood to the lungs, forming one half of the lesser or pulmonary circulation. We have next to notice the contrivance by which the blood is admitted to pass into it, and a return totally prevented, for this opening is in health completely closed by its valves. This arrangement consists in three valvular folds of the lining membrane of a semilunar shape attached at both horns and by the convex edges to the sides of the vessel, hanging in festoons like the curtains of a window, the three completely surrounding the vessel. In the center of the free margin of each we have a small body more solid and round in form these are called the Corpuscles of Arantius and have for their office the closing of the minute opening left between the points of the three folds. These valves are called the semilunar, and open by the pressure of the blood, towards the lungs, after the passage of which the blood in its tendency to regurgitate insinuates itself behind the loose folds and forces them down so as to effectually prevent a return. It must be remembered in the study of these valves that the blood instead of being sent into an empty fixed tube is admitted by the exercise of superior force into an already distended vessel, and that the 2 oz which is about the quantity thrown by the ventricle is forced in at one end whilst the same quantity must flow out at the other, and that the elasticity of the vessels always exercises a pressure upon its contents which instantly that the superior pressure of the ventricle is removed, forces down the valves with some power.

Pulmonary artery

festooned curtains

not into an empty tube

Superior force

2 oz

Elasticity

**Lect. XXVI**

Having at our last meeting finished the consideration of the right side of the heart, or the right heart of Black Blood of Bichat, we continue to day by tracing out the lesser or pulmonary circulation which will bring us to the left, or heart of Red Blood. You will remember that this great vessel carrying venous blood to the lungs, is called the pulmonary artery on account of its structure, and the direction in which it conveys the fluid. It is as you see a very large trunk which divides before having proceeded far, into two great branches, the right and left, each going to its respective lung. Each of these upon arriving at the root of the lung, again divides into a number of radiating branches. These again branching into capillary minuteness, cover and are distributed upon, the bronchial vesicles or terminal air cells of the lungs, amounting in numbers to many millions in all. These arterial capillaries terminate upon the air vesicles, continuously, in the capillaries of the pulmonary veins, which convey the blood, after having been changed by exposure in the vesicles, into successively enlarging trunks, which finaly terminate in the left side of the heart. Thus we see that the continuation of the capillary divisions of this pulmonary artery, after having exposed the blood to the changes by respiration, and turned its course again towards the heart, - becomes pulmonary vein whose office it is so to return the red blood. These veins carrying arterial blood, enter the left auricle by two trunks from each lung, as I draw up the heart from its position you may see these four trunks as they pass in, two coming in each direction. Now as the left auricle is upon the left side of the median line of the body you will observe that the two right veins are somewhat longer than those of the opposite side, which excess is of course attributable to this peculiarity of position, Each of these four veins is made up of many thousand smaller ones from all parts of the lungs in passing towards the root behind the great vessels which convey the blood away from the organ, hence we see the necessity of the left auricle being at the posterior part of the organ, This position which also holds good with regard to the ventricle throws the corresponding cavities of the right side almost in front. This has given rise to their being sometimes called

There is iron enough in the blood of 42 grown people, it is said, to make a Ploughshare.

respectively Anterior and posterior hearts. This portion of the heart is well shown in the subject before us, wherein we are obliged to raise the heart up from its position in order to get at the left auricle. This cavity we will now open in order to get a view of its internal structure and arrangements. These after having noticed the position, we shall be better able to study upon one of these preparations which have been removed from their connexions. We notice first that like that of the opposite side it has its ear like portion called the left auricular appendage, which however differs from the first somewhat in the greater irregularity in shape which it presents. This cavity we also find to contain some blood, for the removal of which and to show the full dimensions we shall slit the cavity entirely open. At first sight this would strike us as being smaller than that of the other side, but this difference is rather apparent than real, as it has very nearly the same capacity. This holds good with regard to the other correspon-ding cavities, all being in a normal condition of very nearly the same size. It is true that in advanced life we find the right side rather more capacious than the left, attributable wholly to the regurgitation through the tricuspid valves becoming greater from a decreased activity on the part of the valves, thus admitting of more of the blood escaping through this passage in contraction of the cavity, and there-on less going through the lungs to be accommodated upon the left side, for we know that when we attempt to inject the ventricle with mercury in old people it flows through into the auricle with greater facility. The corresponding valves in the opposite side are however from necessity perfect, as any reflux here would cause stagnation in the lungs and prejudice life. As I split open transversely this left appendage which of course constitutes a part of the cavity, you perceive its irregularity. We are first attracted again upon opening this auricle by the glossy smoothness of the lining membrane, which is a serous one, analagous to that seen upon the opposite side, being contin-

right side more capacious in the old

of course with the lining of the pulmonary veins, the corresponding ventricle and the arteries throughout. This membrane is slightly different from that of the opposite side of the heart and the veins in general, being less liable to inflammation than they are. This nevertheless does occasionally occur, giving rise to the affection called endocarditis. In contrasting the appearance of this auricle with that of the right side, we are struck by a supposed absence of muscular fibres giving rise to that pectinated appearance so marked in that instance. This however does not arise from an absence of muscular tissue, but on the contrary from an increase in this respect, for here instead of being intermitted they are spread smoothly and continuously over the whole surface, leaving no diaphanous portions visible, and doing away with that rugous or furrowed appearance. Between the auricles of the two sides we have only interposed a thin septum, called the septum auriculorum, in which we again notice the remains of the foramen ovale of the foetus, the annulus, and the adherent valve of Botal. This septum consists like the walls of the cavity of muscular fibres, which are even found in this portion which constituted the valve of Botal. In early foetal life these auricles are developed as one cavity, having free communication through this septum, but long before birth there commences to grow from the sides of this foramen a portion of the tissue of which it is composed, ~~which~~ which stands out vertical, and allows the fluid to pass unimpeded. At this time the lungs are in a perfectly collapsed condition, and cannot circulate the blood through their tissue, it is therefore reflected from its course by the valve of Eustachius, and instead of going into the right ventricle to be forced into the lungs, it is directed through the foramen ovale into the right side whence it is distributed to the whole system. The moment the child breathes however, the lungs by their distension invite the blood into them, which being returned to the ~~right~~ left side through the pulmonary veins, comes to exercise an equal pressure on this side of the septum, and throws down this vertical valve, which then from a degree of vitality existing ~~ink~~ in it soon adheres and closes

up entirely the opening, We next notice the opening between the left auricle and ventricle. This corresponds to the one seen upon the opposite side and is called the Ostium Arteriosum, or left auriculo ventricular opening, being of very nearly the same size as that of the opposite side, We now open the ventricle of the left side and in doing so we observe that it extends to form the apex of the organ, that of the other side not attaining the same length, We notice here an extension of the same lining membrane which we found in the auricle giving that same shining surface, The walls of this cavity are as you see much thicker than in either of the other cavities, and this comports perfectly with the function to be performed by it, namely that of sending the blood to all the body, whereas the other only sends it to the lungs. These parietes are here about half an inch thick, which is about the average, for when you meet with them either much more or less it will be as a consequence of hypertrophy or atrophy. Those of the right side measure generally about one third that of the left, but the variations from these rules are numerous, for in a majority of cases the heart shares in the increased or diminished devel-opement of the general muscular system, therefore where this is well developed you look for a full developement of the heart, without considering it as a mark of disease, The same arrangement of Columnæ Carneæ and Cordæ tendineæ obtains here, that we found in the opposite side filling the same offices for the more perfect valves exis-ting here, to which we will now turn our attent-ion, Instead of being tricuspid, the doubling of the lining here is divided into two valves, which from presenting when extended a round opening with a bifurcated top, was supposed to resemble the mitre worn by the bishops, and hence termed the mitral valve, One side of this is larger and longer than the other, and as you see the entire border of both is scolloped out at the points of which scallopes are attached the numerous Cordæ tendineæ for the purpose of prev-enting the blood from pushing them into the auricle

The extent of these two valves just equals the area of the opening, so that in contractions of the cavity, the blood getting behind these cords, force them down so as to completely close the opening, and permit of no regurgitation whatever, When shut off from a return through this opening it finds another outlet in the mouth of the great aorta, through which the arterial system is supplied, You will observe that the whole interior of this ventricle presents a rough honey comb appearance which is doubtless not without a definite purpose, And it is suppose that this riddling as it were of the internal structure subserves the use of increasing the surface for the action of the blood which is the proper stimulus of the organ, - in order to a strong contraction It is however all smooth and polished to a degree which offers the least obstruction to the impetus of the fluid You observe when I cut through the Columnae Carneae the excess of size which one of these valves has over the other, and see also that the larger one is upon the side next to the mouth of the aorta, and placed immediately between the two openings, This valve is by this arrangement made to perform a double office, the additional one being that of closing the mouth of the aorta while the blood is forced into the ventricle by the contraction of the auricle, By this mechanism the entrance of any blood into the aorta except by the legitimate contractions of the ventricle is prohibited, and the phenomenon of an intermittent pulse from this cause precluded. These valves are particularly prone to disease in comparison with those of the opposite side, Cartilaginous or ossific depositions being met with here in almost every case when any disease at all exists, Indeed I have only twice in my life met with these degenerations upon the right side of the organ, and in these two there was a great degree of hypertrophy which at once accounted for the occurrence, as the increased motion and greater duty of those of the left side would seem to be the only cause of a difference in liability. At least this seems to be the only appreciable efficient cause, We now have to direct our attention to the large opening by which the blood escapes into the aorta, and we find this situated at the base of the

organ and near to the ostium arteriosum, we find the mouth or orifice of this great trunk closed by three valvular folds of a semilunar shape, similar to those of the pulmonary artery, and called the semi-lunar valves of the aorta. These you may now see as I open the vessel above, surrounding it in festoons like the drapery of a window, being attached at three equi distant points, in such a manner that the least tendency to a reflux of blood must catch the free edges and throw them together. They like those of the opposite side of the heart are furnished with small bodies placed in the center of each free margin, by which the more completely to close the opening. These are the corpuscles of aurantius and are generally the points first attacked by disease, sometimes being found as large as peas when their natural size as you see is not that of the smallest pin head. Behind each one of these valves there exists a kind of pouch or dilatation of the vessel, in order to admit of the insinuation of the blood behind to close the valves with facility. These are called the sinuses of valsalva from the anatomist who first observed them. Although the appearance of the artery internally is that of the ventricle, a little examination below the lin-ing membrane will show a marked difference, the one consisting wholly of muscular fibres, whilst the other is composed of a peculiar elastic or contractile tissue, whose action is very necessary to the circulation of the blood. Thus when by each pulsation of the heart two ounces of blood is forced in the vessel already full of blood, the same quantity is not instantly displaced, but by the constant pressure of the elastic vessel this flow into the smaller vessels is made continuous whilst as we know the action of the ventricle is intermittent. In ossification of the valves or cor-puscles of the aorta, an accurate closure of this opening is prevented; so that when the blood is ad-mitted from the auricle it finds the ventricle already part full, and of course not receiving the proper amount from the auricle, - this gives occasion

Cardiac

to a backing of the blood onto the lungs, causing ast-hmus, Angina Pectoris, and many affections of the heart and lungs. The construction and arrangement of these valves and orifices may be advantageously studi-ed upon the heart of the Bullock, as its enormous size admits of a clearer view. Some of these are upon the table and may be examined by you after the lecture. We now have to examine for a few moments into the arrangement of the muscular fibres of which this hollow muscle the heart is composed. We find the basis or ori-gin of the major part of them is from an annulus or ring which consisting also of muscular fibres, surrounds each auriculo ventricular opening; surrounding the orifice of each large artery there is also a ring, and from these as points of origin spring the bands of fibres which enc-ircle the heart in a spiral manner to be inserted again into the opposite side of the ring. In many of the inferior animals we find a bone called the bone of the heart, from which these bands arise. This however does not obtain in man, the different planes both of the auricles and ventricles arising from the point before men-tioned. In this specimen of a bullocks heart, you see the fibres have been dissected out as clearly as in any muscle in the body, and show distinctly the spiral course of the outer plane. The internal direction of the fibres however is much more intricate, the outer layer we are able to dissect out to the apex where it appears to enter the septum cortex like a worm, and is lost among its fibres. This septum between the ventricles is generally considered to be the origin of these common bands by which the two are bound together. This arrangement is made more evident by these plates of Mr Quain, but the most simple mode of considering the structure is, to conceive of two muscular bags placed in apposition and confined there by an extra layer which envelopes both, having its origin between the two and an insertion into the ring at the base. I here show you a diagram of Mr Quain in which he exhibits the course and direction of the long and short bands of fibres by which the organ is surrounded, showing them to be connected with the Columnae Carneae upon the inside of the cavities. This however is not of any great practical importance and we will therefore take up

no more time with it. We now have to notice the manner in which the aorta leaves the heart and the direction which it takes to form its arch. This although coming from the left or posterior side of the organ, by a peculiar twist passes in front of the pulmonary artery which lying somewhat to the left divides to go to each lung, the right branch passes immediately under the aorta in its course, and here in foetal life we have another arrangement by which the blood is diverted from the lung. This is by means of a vessel called the ductus arteriosus, which passes from the pulmonary artery into the aorta. This transmits whatever part of the blood that has failed to get through the foramen ovale, into the common aorta, by which it is distributed to the body and prevented from going to the lungs where it would probably produce an engorgement and inflammation. The arch of the aorta for the purpose of giving origin to the vessels of the upper extremities, is formed on a line from the anterior extremity of the third rib where it joins the cartilage on the right side, to the posterior extremity of the third rib of the opposite side. In aneurisms of this arch, the pulsation may sometimes be felt below the top of the sternum so high does it sometimes rise, and a case is mentioned in the books of a dropsy of the pericardium, which stopped up that membrane so far as to present fluctuation at the top of the sternum. The branches given off by the aorta at its arch are first the arteria innominata, which afterwards divides into the right primitive carotid and right subclavian arteries, and secondly the left primitive carotid for distribution to the left side of the head and neck, and thirdly the left subclavian artery which is distributed to the breast shoulder, arm, and forearm, each of which we shall hereafter have to notice in detail. Having now gentlemen finished the consideration of the great nervous and circulatory centres we are prepared to go on with the study of their distribution over the economy, in conjunction with the muscles which they concern.

Lect XXVII.

I propose to day gentlemen, to commence the demonstration of the muscular system, in pursuance of the plan which I have adopted in accordance with the one ordinarily pursued. And the first muscles which we shall take up for consideration are those of the back. When we dissect off the skin from the back or from any part of the body, we do not at once as you perceive uncover the muscles, and I may remark that here upon the back the skin exceeds in thickness, that found upon any other part of the body, with the exception of the heel, This, I say, is not placed in immediate connexion with the muscles, but has interposed between, a layer of substance which envelopes the whole body and is called the superficial Fascia, When there exists muscle below the integuments or skin, this forms the communication between them, when the bone is superficial, this tissue unites the periosteum to the superjacent skin, In the case of the muscle it aids by its inner surface in the formation of the proper sheath ~~of~~ This consists of Condensed Cellular tissue, compacted so as to give it strength and elasticity, being of the same nature but more firm in consistence than that forming the proper sheaths to the muscles. By the interposition of this elastic tissue upon which the skin as well as the muscles can slide, the superficial integument is not contracted and corrugated by the action of the muscles, which would in many cases produce disfiguration, particularly about the face, which by the contractions would be thrown into the ~~most~~ distorting positions of caricature, This fascia is often found filled to a greater or less degree by fatty deposits ~~forming~~ cushions as it were for the various parts, and giving rotundity to the asperities of the muscles, This is particularly the case about the face, buttocks, &c. Not however to any degree in the back. It is very adherent as you may perceive, to the spinous processes of the vertebra, for the whole length of the column from the sacrum to the occiput, This adherence is to such a degree that in the case of abscess under the fascia of one side you almost never find that of the opposite side involved, although it may dissect it up from the muscles for a great distance, I have ~~seen~~ however ~~but few~~ many seen cases in which the pus passed across to involve the opposite side, As I raise this fascia, you may form some idea of its thickness, elasticity and great strength, So resisting is it that I have seen instances in which the matter of an abscess has burrowed

under it all the way down the back before it had become softened sufficiently to give way and permit its escape. In such instances it is therefore always proper for the surgeon with his bistoury to interfere and prevent this extensive implication by an early incision. As I turn of this skin and superficial fascia, I bring into view a large and beautiful muscle, which from the figure which those of the two sides taken together represent has been called the

## Trapezius

The two forming an irregular four sided plane bounded by four angles, This is also sometimes called the cucularis muscle from a fancied resemblance to a monks hood thrown over the shoulders. This muscle is extended over the upper part of the back and neck, having as we shall see a very extensive origin, The commencement of its origin is for about an inch upon the upper transverse semicircular ridge of the occipital bone, and from the central prominence, then from the ligamentum nuchae of which I some time since spoke as existing only in a rudimental condition in man, whilst in animals particularly the ruminantia, it was of great strength and importance, You will remember that it is situated between the spinous processes of the upper vertebrae and is composed of that yellow elastic ligamentous substance known as the tissue jaune, It here subserves the purpose of giving origin to muscles, and not for the purpose of supporting the head. Through the intermediation of this then the Trapezius arises from the five superior spinous processes of the neck, by direct tendinous slips from the two lower, and from the whole of those of the back, From this extensive origin the upper fibres descend, the middle run transversely and the lower ascend. to be inserted into the whole spine of the Scapula and the outer third of the Clavicle, It will aid you perhaps in recollecting the insertion of this muscle to know that it is exactly that of the origin of the deltoid, with which muscle it acts conjointly by giving stability to its origin whilst in the performance of its function of raising the arm with any weight which may be required, thus forming as it were almost one muscle originating from the spine,

This is the office which is fulfilled by the action of all parts of the muscle at once, But I wish you to understand now in the commencement of our study of the muscular system that it is by no means necessary that all parts of a muscle must act when any part is required. For as the muscles are composed of a great number of fibres and these united into fasciculi, each of which has its appropriate vessels and nerves, - and as they are but the instruments for the manifestation of the nervous influence, - each fibre or fasciculus may act as independently as the entire muscle, and these actions are regulated by the necessities of the economy, or the expression of volition through the nervous system, Thus when the superior fibres of this muscle alone act, we have the scapula somewhat rotated or tilted up-wards, whilst all the rest either singly or collectively act in accordance with their direction, In the description of muscles we speak of their points of origin and insertion, Now in what do these differ, or how are they distinguished? We generally consider that point to be the origin which is the most fixed, or that from which the muscle acts, - and as the insertion, that which is the object acted upon, or the most movable point. This law or rule is however very liable to vary or be inverted, as each point may become the fixed or movable one, according to the circumstances of the case, for instance if we fix the scapula and shoulder by seizing something with the hands, and then call this muscle into action, that action will be from insertion to origin, or adverse from that laid down, This applies to all the other muscles of the body as we vary the circumstances of their action, We now turn down this muscle and in so doing we observe that where it crosses the superior angle of the scapula we have the rudiment of a synovial sack or bursa, - generally found more perfect than in this instance, We now turn our attention to the second muscle of the superficial layer of the back, namely, the

## Latissimus Dorsi

Which is very appropriately named as being the broad ~~and long~~ muscle of the side and back, It is as you see a very strong fleshy muscle covering in a great part of the side and lower part of the back, It arises from the seven inferior spinous processes of the back and below this from an exceedingly strong and dense fascia

which is found covering the lower regions of the back This is called Fascia Lumborum, and arises from all the spinous processes of the lumbar vertebrae and sacrum - from the body of the sacrum, and from the posterior part of the crest of the ilium; Thus in arising from this fascia its origin is most extensive covering the whole of the posterior inferior part of the trunk, It also arises by four fleshy slips from the four inferior ribs, in the case before us however by only three, From this extensive origin it runs upwards outwards and forwards crossing a small part of the inferior angle of the scapula where it generally gets a slip of origin, and where there always exists a Bursa, from this point it is accompan-ied by the teres major muscle to be inserted by the in-tervention of a tendon into the posterior edge of the bi-cipital groove upon the Humerus. These two muscles in crossing from the trunk form when covered by the integuments the posterior fold of the axilla, When we wish to ascertain the action of any muscle in our anat-omical examinations, we do it by so moving the parts as to render the muscle tense, and by moving the arm upwards and forwards in this case you see at once the direction in which this acts, for this action consists in a shortening of the fibres by throwing them into a zig zag form. Thus the direction of the member under the controll of this muscle would be downwards and backwards, hence the vulgar name which it has received from the ancients, When however the arms are fixed by grasping something above, as the boughs of a tree, the action will be to raise the body up to them, this is therefore a muscle used in climbing or wherever the arms are made to aid in the progression of the body. The connection which it has with the ribs, must also be for some special purpose rather than to afford attachment to the already very extensive one which it has, This is in order that it may be ren-dered efficient in forced respiration when additional aid is required, thus we see that by fixing the arms the contractions of this muscle may be made useful in cases of forced inspiration from any cause, by drawing up the ribs, and increasing thereby the cap-acity of the chest, I have seen cases, where indiv

-iduals without knowing why, have under the influence of violent paroxysms of dyspnœa, ran and hung themselves as it were by the hands to the ~~top~~ of a door, in order to bring this muscle into play as a respiratory one, being directed by the instinct of nature to that means of obtaining relief, you will also often see individuals grasp the sides of the bed or the arms of a chair in these paroxysms with the same instinctive purpose. The next muscle to which I will call your attention is this one, or rather two, which connect the scapula to the spine. These

Rhomboidei,

As they are called from their beautiful square shape

They form a plane of muscular fibres running between the spinous processes of the neck and back and the base of the scapula. They present at first sight the appearance of but one muscle, and indeed they are only divided artificially by some vessels which pass in the direction of the fibres, the distinction having been made by Albinus whom we generally follow in descriptions of the muscles has still been adhered to. The superior one or Rhomboideus minor generally arises from the three lower spinous processes of the neck, in this case however by only two, and the inferior or major Rhomboideus, sometimes from the lower spinous process of the neck with the four and sometimes five upper of the back. From these points they run downwards and outwards to be inserted into the whole base of the scapula. The action of these must be apparent from the direction of the fibres namely to draw the scapula upwards and backwards. And another important function is that of keeping the scapula fixed whilst ~~whilst~~ the arm is being used. We find in most adult subjects, a slight curvature existing in the spinal column just at the point of insertion of this muscle, which is however perfectly consistent with health and results from the unequal action of the muscles of the two sides, by the greater use of one arm. This curvature however is found to take place in a direction opposite to that which at first sight would seem to be indicated, thus in persons who are right handed, the concavity of the curve will be towards the left, and v.v. A moments thought will however serve to account for this, by considering that the excessive action will be transferred to the muscle of the left side in the endeavours to keep the spine fixed,

the muscle of the right side being more passive. Thus in this way the spinal processes will be made to deviate towards the left instead of the right side, As we turn off these rhomboidei we bring into view another which from its function has received the name of

## Levator anguli scapulæ

serving to raise the angle of the scapula towards the head, This muscle has its origin from the five superior transverse processes of the neck, by as many fleshy slips which might be dissected down so as to form as many distinct muscles almost. From this origin it passes to be inserted into the superior angle of the scapula. From the action of this muscle in bringing up the angles of the scapula in that shrugging manner which is supposed to indicate patience or endurance the french have called it musculus Patientiæ, From the fact of the scapula being quite movable having no bony connexion whatever with the back part of the chest, the fixed or comparatively fixed point at the shoulder forms the fulcrum for all its motions, these consisting of partial rotation or tilting rather than ~~a~~ direct ones. The next muscle which we have to consider is this beautiful little one called the

## Serratus superior posticus.

So called from the position which it occupies with relation to some others, and from the teeth like attachments which it has to the ribs, This muscle arises by a tendinous expansion ~~or sheet~~ from the three lower spinous processes of the neck and the two upper of the back, generally but in this case from only two of the former, there being an almost constant variety in the number of these origins and insertions, and proceeding downwards and outwards is inserted into the second, third, fourth, and fifth ribs externally to their angles. A contraction of this muscle we must at once see will raise the ribs, and it is therefore one of the respiratory muscles, being concerned in ordinary inspiration by enlarging the capacity of the chest for the admission of air, This muscle is antagonized by one of the same character upon the lower part of the back to which I will now call your attention. To see this we must divide the belly

of the latissimus dorsi muscle and turn it off, when we have brought into view the

## Serratus inferior posticus.

Each one of these muscles although laying so compactly together, we find enclosed in its own proper sheath of condensed cellular tissue by which their actions are confined. In dissecting up this latissimus dorsi we find the tendon or origin of this muscle so closely connected with that, that it becomes finally impossible to make a further separation, but we find that its origin is from the two inferior dorsal, and the three superior lumbar spinous processes, and from this being exactly analogous to that of the superior serratus, substituting those of the neck for those of the loins and upper for the lower dorsal, - it is very easy to remember them both. From this origin it runs obliquely upwards and forwards to be inserted by as many fleshy slips, into the four inferior ribs. This is a somewhat stronger muscle than the upper one, from having to antagonise both that, and the costal portion of the latissimus dorsi. The action of this muscle is then of course to draw down the ribs, by which the cavity of the chest is decreased, it is therefore a muscle of expiration. The next muscle to which I must direct your attention is that called the

## Splenius.

This is a strong fleshy muscle, situated upon the side of the neck below the levator anguli scapulae and the trapezius, being divided by anatomists generally into two parts. It arises by tendinous slips from the spinous processes of the four upper dorsal vertebrae, and from the same processes of the five lower cervical vertebrae, making nine in all. From this origin it grows fleshy and as it ascends, diverges from the spinal column permitting the shining belly of the complexus muscle to be seen between them. One portion of it then goes to be inserted fleshy into the back part of the mastoid process of the temporal bone, and into a part of the transverse ridge leading from that process. This portion is called the Splenius Capitis When we remove this portion by cutting it across we discover another fleshy belly beneath going to the two upper transverse processes of the neck, where they are inserted by two strong tendinous slips, being divided from each other for some way down the muscle,

This portion has been designated as the splenius Colli from its belonging to the neck, in distinction to the other which was inserted into the head, Under ~~the belly of~~ this muscle near its insertion on the mastoid process runs the occipital artery a branch of the external Carotid which runs to be distributed upon the back part of the cranium, This artery it is sometimes necessary to tie, in accidents about this part of the head, and this must be done by cutting through the integuments and belly of this muscle, The separate action of these muscles is to draw the head downwards to one side and to turn it somewhat, but if both act, the occiput will be drawn immediately backwards in the middle line, This is one of the muscles by which mountebanks and boys are enabled to maintain their equilibrium whilst standing upon their heads, in this case inverting the action of the muscle from origin to insertion, This is also one of those particularly concerned in turning somersets as the clowns do, This completes the demonstration of the superficial layer of the muscles of the back, and we shall next have to consider those which make the proper erector spinæ muscles, and are seated immediately along the course of the spinal column, I will now draw your attention for a moment before we pass to this cut which I have made through this aponeurotic expansion or lumbar fascia, You notice that the muscles below have from the removal of the confining force above them, a tendency to, and have really made a hernial protrusion through the gap, This takes place equally upon the living subject, as many of you witnessed when I was obliged in the removal of a tumour at the Hospital, to cut through the aponeurosis of the triceps muscle of the arm, at our last meeting there, This exhibits at once the office of these tendinous expansions and fascias which we find throughout the body, and the protrusion through the rupture of some of the fibres is probably the cause of that acute sickening pain which characterizes lumbago, the parts probably presenting ~~the~~ an appearance analagous to that which you see here, the muscle being no longer confined to its proper place.

Lect. XXVIII. Having at our last meeting described and shown you the layers of Superficial muscles found upon the posterior part of the trunk we shall to day proceed to ~~which~~ those which situated more deeply, have their entire action upon the trunk head and neck. The largest and most important of these extends over the entire back of the thorax and loins, covering the posterior extremities of the ribs and filling up the large gutter on each side of the spinous processes, being known generally, and sometimes described as the erector spinae muscle, from its function of keeping the spine in an erect position. This however consists of, and is generally described as three distinct muscles, the division between which it is very difficult to make out clearly. The two superficial of these three are called the Sacro lumbalis and longissimus dorsi and the deepseated one or that next the bones is the Multifidus spinae. These have a common office namely, that of preserving or aiding to preserve the erect attitude. The glutei muscles upon the back of the pelvis serve to keep it erect upon the lower extremities by their insertion into them, and these erectores spinae by an origin from the pelvis and an insertion along the whole length of the spinal column and ribs, serve to carry out this indication with regard to the trunk, and keep it erect upon the pelvis. These are mainly important from their physiological uses, not being concerned in many of the accepted operations of surgery at the present day. They have a common origin from the spinous processes of the sacrum down to the coccygis, and also from those of the loins, - from a part of the back of the sacrum or its region, forming a tendinous expansion by turning up which we find they also have a fleshy origin from the same and contiguous surfaces, which principally goes to the formation of the internal part or multifidus spinae. There is also some muscular slips which come of from the transverse processes of the loins forming a part of the common origin of these muscles. Having thus shown the origin of the mass, we will now trace up to their insertion these two superficial muscles, We find by turning up the combined mass where it passes over the Quadratus lumborum muscle that it has some insertions as low down as this point, into the transverse processes of these vertebrae. These are other fibres which come from the lowest and outermost points of the sacrum and by their contraction tend to incline the spine in the lumbar region, whilst those fibres

which originate from these processes run up to be inserted into the ribs above, and exert their action upon the next portion of the column in the order from below upwards, to give it a somewhat lateral inclination. As we trace up the mass consisting of these two muscles we find that just opposite to the last rib they may be first fairly separated in such a manner as to distinguish the one from the other, the Longissimus Dorsi lying next to the spinal column which the Sacro lumbalis occupies a position upon its outside. The

## Longissimus Dorsi

we find here dividing into numerous slips or bands and running out by small tendons to be inserted like so many cords, into the transverse processes of the vertebrae of the back with the exception of the first. These act like so many cords in the hand of another ~~person~~, by the individual or conjoined action of which upon their points of attachment, the whole or a part of the column may be inclined, or by those of each side acting conjointly, may be bent in the direction of the existing curves in the median vertical line of the body. In addition to these points of insertion we find a fleshy slip from the muscle inserted into each rib with the exception of the lower two floating ones. This insertion is just within the angle, and of course the action must therefore be slight except in the manner of the other parts of the muscle, say by inclining to one side, or preserving the erect attitude. We next take up the portion which constitutes the

## Sacro Lumbalis.

This portion is much the smaller of the two, and as before noticed is upon the outside of the first, its termination upwards is by a number of slender tendinous processes which run to be inserted at the outer edge of the muscle into all the ribs just outside of their angles. As we turn up this sacro lumbalis muscle we discover a number of fleshy slips arising by distinct heads from the ~~upper~~ lower ribs and running to join this muscle as so many additional origins. These generally number from six to eight and are called musculi ad sacro lumbalem accessorii. This acts as an expiratory muscle by depressing the

ribs and rendering their capacity^the thorax^ less. and in this manner antagonize the slips which we found upon the Lattissimus dorsi which acted in a contrary direction. This phenomen-a of Antagonism is worthy of observation, as it obtains throughout the muscular system, for whenever you have a muscle to perform a certain office, or wherever you find a muscle to place a limb in a certain position, you will always find one or more to counteract it, or replace the limb in the original position, This fact should be remem-bered as it tends to simplify the study of the numerous muscles by placing them in groups in accordance with their functions and giving them functional designations We now pass upwards in our examination to the upper part of the thorax and neck when we find a number of little muscles somewhat complicated in their arrangement but of little physiological importance, taken up now in consequence of their connexion with the muscles last considered, The first of these is the

## Cervicalis Decendens.

This appears to be and is in reality a continuation of the sacro lumbalis muscle above the point indicated as its insertion, This considered as a distinct muscle may be said to arise from the four or five upper ribs and runs to be inserted into the transverse processes of the fourth fifth and sixth cervical vertebra, by distinct tendinous slips The action of this will of course be to bend the neck to one side or both acting, to draw the neck and head backwards We find another small muscle in this region, an app-arent continuation in the same manner as the last,- of the longissimus dorsi, This is called the

## Transversalis Colli

or Transversalis Cervicis, being very appropriately named as it runs from transverse process to transverse process, This muscle has its origin from the five or six upper tra-nsverse processes of the back and runs up to be inserted into the same processes of the five middle vertebra of the neck Its action is of course precisely the same with that of the one last described, namely to incline the head to one side The next is situated by the side of and connected with the last named muscle and is called from its situation and insertion the

## Trachelo Mastoideus

This arises from the three four or five upper transverse processes of the back and by three or four, sometimes five lower ones of the neck by as many tendinous and fleshy slips and is inserted by a thin tendon into the back portion of the mastoid process of the temporal bone. Its action of course will be felt most upon the head, and tend to turn it to one side over the shoulder, or if both act at once to draw it directly back, antagonising the Sterno Cleido Mastoideus muscles on the front of the neck. We now turn off these muscles and in ~~contamination~~ come next to this which is called the

## Spinalis Dors.

But which is not worthy of the name as it is a mere part of the longissimus dorsi from which it cannot be dissected, the division always being wholly arbitrary. In this dissection which has been made with the greatest care, you see that to make any division I must divide this thin strip of fibres across making as it were an artificial separation where none existed before. This arises by as many long tendons from the spinous processes of the two upper vertebra of the loins, and the three lower of the back, and is inserted in the same manner into the spinous processes of the nine upper dorsal vertebra with the exception of the first. Its action the muscle being so small of course cannot be great, but it tends with the rest to preserve the erect attitude of the column. We next come to notice an important and powerful muscle which from its complex nature is called the

## Complexus.

This muscle is seated deeply and covers in the back part of the neck and upper vertebra, and is intermixed throughout with tendinous fibres. It has its origin by tendinous fibres from the seven superior ~~spinous &~~ transverse processes of the back and from the four inferior of the neck receiving in its ascent, a slip from the spinous process of the ~~first~~ two vertebra of the ~~back~~ neck, from whence it runs to be inserted into the space between the ridges which cross the occipital bone, occupying the principal part of this space, and with its fellow of the opposite side also occupies a part of the vertical line found upon this bone. This is a very strong muscle and exerts its force of course upon the head in the ordinary condition, pulling

the head backwards and to one side or when both act directly backwards, The action is of course inverted when the head is made the base of support, and it is one of the muscles concerned in turning a somerset ~~action~~, Its action resembles that of the Splenius very much, running in the same direction, We next have two muscles named from their origin and insertion semi spinalis dorsi and colli having their origin in the transverse processes and their insertion into the spinous processes, The first or

## Semispinalis colli.

Has its origin from the transverse processes of the six upper vertebra of the back by as many tendinous slips from which it inclines gradually inward to be inserted into the five middle spinous processes of the neck, the action of course will tend to incline the column to one side, Immediately below this we have the other called the

## Semispinalis Dorsi,

This is a precisely analagous muscle and has its origin by tendinous slips from the seventh, eighth, ninth and tenth, and sometimes more, transverse processes of the back and is inserted in the same manner into the five upper spinous processes of the back and the two lower of the neck, The analogy between the origin and insertion of these muscles will of course extend to their action, We next come to the consideration of the

## Multifidus Spinæ

muscle, To bring this into view we must turn off all the before described muscles, upon effecting which we notice, filling up all the excavation or gutter upon the side of the spine from the sacrum entirely up to the neck, a mass or congregation of fasciculi running in various directions This is a much larger muscle than we might at first be led to expect covering in entirely the ends of the ribs and bodies of the vertebra, We now notice in addition to the common origin before spoken of, that it gets slips from the transverse and oblique processes of the vertebra of the loins, which go to make up the muscle, It consists in fact of a series of muscles joined together, having their origin from one vertebra and their insertion into some succeeding one, the whole being united together by intermixing muscular fibres Its insertion is into the whole of the spinous processes of the loins,

back, and neck except the first. Its action is clearly that of the other erectors of the spine the whole of which might be classed and described together with much advantage. These muscles were supposed by Guerin a surgeon of Paris, to be the agents in producing the lateral curvatures so often met with, by becoming hardened and shortened in a contracted condition in the same manner that these are in ordinary club foot, and he proposed to remedy them in the same way, by a subcutaneous division. This however was not found to be the most successful mode of treating it although tried a number of times, and therefore has not received much favour in the profession. The ordinary mode of extension, and stimulating and strengthening the muscles of the opposite side as proposed first by the celebrated anatomist Wilson, by exercise and carrying weight upon the head is found to be the more efficient means of establishing a cure. The supporting of a weight upon the head has been found to be an excellent mode of developing the muscles of the spine, and putting them into a healthy condition, and upon the same principal of use, that a blacksmiths arm becomes fully developed by the use of the hammer, for it has been often noticed that those porters and persons who are in the habit of carrying fardels upon the head always have these muscles verly large, and in a very healthy condition. So situated they have no difficulty in holding the column erect, but in boarding school girls, who sit all day long in one position and take no exercise at all, they become enfeebled and give way under the incumbent weight. There are no important vessels or nerves to interfere with cutting operations in this region, and such are seldom required. The muscles are supplied below by the posterior sacral and lumbar arteries, further up by the intercostals which send out branches to this region, and in the neck by branches from the vertebral and occipital arteries which also give of considerable branches in their course. Thus a free supply is given here as in every other part of the body, for this is the necessary condition to the proper action of the muscular system. The nerves which go to supply these muscles

come principally from the posterior branches of the inter costals. in the neck from the posterior Cervical branches which spring off for the purpose, all coming originally from the spinal marrow, The manner of this distribution is better shown by these beautiful plates where they are very clearly delineated, We have seen that the nerves originate by two roots an anterior for motion and a posterior root of sensation, - that these unite shortly after their origin and enter the intervertebral foramen, after passing which they again divide into two branches, one of which runs forwards and the other backwards to supply these muscles and integument on the back, - This last branching does not consist of a separation of the motor from the sensorial filaments as before, but each branch is made up of a mixture of both kinds, which is continued until the final distribution when the motor fibres are principally distributed to the muscles and the sensorial to the skin This completes the inferior posterior region of the body and the few small muscles which follow will complete the anatomy of the entire posterior part of the trunk, These are situated near the head and the first to which I shall call your attention is the

## Rectus Capitis Posticus Major,

This muscle is very small and arises from the spinous process of the dentata and growing broader as it ascends is inserted into the os occipitis upon the outer edge of the foramen magnum, The action of this muscle will be to extend the head and aid in the nodding motions which are alone performed in the upper joint. The next is the

## Rectus Capitis Posticus minor

which lies within the other and arises from the spinous tubercle of the Atlas by a narrow origin and goes to be inserted into the margin of the foramen magnum near the former muscle, This like the preceding one will tend to rock the head backwards, In addition to these we have two oblique muscles which aid in performing the rotary motions of the head, the larger or

## Obliquus Capitis inferior

arises from the whole length of the spinous process of the second vertebra, and is inserted into the transverse process of the atlas, This is a very strong muscle and is quite efficient in turning the head to one side

## The Obliquus Capitis Superior

arises from the transverse process of the Atlas, and is inserted into the occipital bone behind the mastoid portion of the temporal bone, near the insertion of the Complexus muscles. This muscle from its situation and direction will principally act by drawing rotating the head the head back. We have now to notice that between the ribs there exists a number of muscular fibres running obliquely from one to the other. These are called the

## Intercostal

muscles and are arranged in two layers, the one external and the other internal. The external layer arise from the lower edge of the upper rib at the Spine and run obliquely forwards and downwards to the upper edge of the rib below, extending to the junction of the rib with its Cartilage. The internal layer commence at the sternum and run obliquely upwards and backwards to the angle of the rib where they stop. Thus it will be seen that the two layers running in opposite oblique directions decussate each other in the form of the letter X, the external layer being absent near the sternum and the internal near the Spine. Between these two layers run all the intercostal vessels and nerves, a fact which should not be forgotten as it is often of great practical importance. The action of these intercostals is of course to approximate the ribs to each other and fix them for the action of the other muscles of the parts. We have also a number of small muscles of very little importance at the posterior ends of the ribs These are called Levatores Costarum, and arise from the transverse processes of the vertebra to be inserted, some fibres into the rib immediately below and others into the second below thus dividing them into Breviores and Longiores. We have also between all the transverse processes and between all the spinous process, a number of muscular fibres passing, called intertransverse and Interspinous muscles. These in man are composed rather of ligamentous or elastic tissue than of muscular fibre, although in many animals they are very strongly developed.

Lect. XXIX.

I propose to day gentlemen to call your attention to some of the muscles of the face which are interesting mainly as the agents of expression, for it is by their grouped or combined action that the human countenance is made so expressive of the emotions of the mind ~~which affect the understanding~~. This particular examination into their functions as connected with this mode of expression belongs rather to the physiologist than to the anatomist particularly as it includes phonation and articulation, and I shall therefore not enter into it minutely but rather leave it to the Chair of Institutes who will do ample justice to it. I will therefore satisfy myself with pointing out the situation, origin, and insertion of these muscles, and from thence deduce their individual action, and to day shall confine myself to those of expression alone, leaving those concerned more particularly in mastication until a further opportunity, as they would only complicate those under consideration. Under the skin, coming up from the upper part of the chest we have a very thin muscle, with pale and weak fibres, which we shall have more particularly to notice at another time. This is the Platisma Myoides or musculus cutaneus, being almost the only instance in the economy where a muscle has both its origin and insertion into the integuments. The action of this muscle will be of course to draw the skin of the neck into folds or wrinkles being seated in immediate contact with it. A long detached slip from this muscle goes to be inserted into the corner of the mouth, the action of which is to draw down those corners forming that peculiar expression known as the sardonic grin or sneering laugh. This portion is the musculus risorius of Santorini, from the anatomist who first observed the peculiarities of its action. This particular expression is found as an accompaniment to some diseases and is noticed oftener in diseases of the diaphragm than in any other with which we are acquainted. When this muscle with the fascia and cellular tissue beneath it are turned off we bring into view the muscles of the lower part of the face, to which our attention must presently be given. The muscles which surround to the mouth to which our attention must be shortly directed, are very numerous and some of them quite small, - there being nine pairs in

all, without including those situated further back and concerned in mastication, previous to entering upon those we will take up the one which surrounds the eye in order that we may remove it to display those below. This is called from its shape the

## Orbicularis Palpebrarum.

It surrounds the eye as a circular muscle, the fibres lying in a continuous plane over the cheek and a part of the temple and up upon the forehead, so as completely to enclose the eye lids in a contractile band. This is usually described as arising from a small tendon in the internal commissure or Canthus of the eye. This tendon may be readily felt beneath the integument like a grain of rice, particularly if the skin be drawn outwards. It lies immediately over the lachrymal sack and forms the guide for introducing the knife in operations for opening this sack. It is inserted immediately below this and must go, not only through the skin but also through the fibres of this muscle as covers the whole of this part of the face as well as the opening into the lachr sack. From this tendon and also from a portion of ~~the Orbitar plate~~ Int Angl Process of Frontal & nas process of the sup of the superior maxillary bone, the plane of fibres proceed downwards and outwards covering the lower eye lid and all the upper part of the cheek after which it ascends around the outer Canthus of the eye at which point it is connected by cellular tissue to a portion of the temporal fascia in such a way as to form a resisting point for its action, opposite to that of insertion, - from this it again passes on and becomes involved with the fibres of the occipito frontalis muscle, and also with those of a small muscle called the Corrugator Supercilii, from whence it is continued back to be inserted into the same small tendon from which it in part originated, and also into the internal angular process of the os frontis. forming thus a complete circle with a fissure in the centre and attached at two opposite points. The action of this muscle must be evident when we take into consideration its form and attachments. Because when any of the fibres contract between these points they must tend to straighten themselves and thus bring

the edges of the opening together, If there was no other arrangement here than these fibres, they would tend to close the opening by pursing it up into folds. And this we find to be its action in the common toad, whose eye in winking is drawn together in the centre like the mouth of a purse the muscle being here a simple circle and contracting from all points to a centre. But when we become more familiar with the anatomy and mechanism of the eye, we shall find that in the border of each lid there exists a cartilaginous expansion, called the tarsal cartilage, which prevents contraction in the long direction of the fissure, and this with the point of attachment of the fibres upon the outer side is the reason why the contraction exerts itself only in one direction, namely, of drawing down the upper lid and cartilage in contact with the lower, for the upper alone is movable in the action of closing the eye. The occipito frontalis, which we shall have to notice more particularly hereafter, with which this muscle is connected, is a double bellied muscle which with its tendinous expansions covers the whole of the top of the head. The origin of this is fleshy from the superior ridge on the occipital bone, and somewhat tendinous upon the outer edge of the muscle, the muscular fibres after running forwards for a short distance become tendinous forming a broad aponeurotic expansion, which joining with its fellow upon the middle line covers the entire top of the head, being also connected with the temporal fascia at the side, As it gets upon the forehead in front it again becomes fleshy forming the second belly, the fibres of which proceed straight downwards, the outer to be inserted into the orbicularis muscle, and into the small corrugator supercilii whilst the internal ones extend down in the form of a fleshy slip to be connected upon the nose with a small muscle which we shall hereafter consider, This part is called the nasal slip of the occipito frontalis or the Pyramidalis nasi muscle, By the contractions of this muscle the scalp is moved backwards and forwards, and the forehead thrown into transverse folds or wrinkles, Its action of course being also exerted upon the orbicularis muscle, which it draws up and gives to the eyes that wide staring look characteristic of wonder, This action upon the eye lids has been taken advantage of in an operation proposed first by

Mr Hunt, and very frequently performed in cases of par-
-alysis of the upper muscle of the eye lid, by which it
is opened, This operation consists in the removal of
an elliptical piece of skin from the eye lid, and
bringing the edges together and so maintaining them
until they adhere, - by this means the eyelid is placed
under the control of the occipito frontalis muscle which
keeps it open and enables the patient to see, I next
direct your attention to a small muscle which
may be seen to more advantage upon this large dra-
-wing, This is the

## Compressor Naris

It arises by a narrow slip at the root of the ala of
the nose, and from thence spreads out into a somewhat
triangular shape over the dorsum of the nose, inclining
rather upwards. The upper fibres do not run straight
as may be seen, but present a concavity upwards.
The two muscles from opposite sides join upon the
ridge of the nose, and are somewhat connected with
the ends of the nasal bones. The direct action of
this muscle will be to constrict the nostrils, as when
we wish to exercise the sence of smell acutely, by
lessening the apertures through which the air passes,
But it is attached to the nasal slips of the occipito
frontalis as before noticed, by the action of which
it is drawn upwards and serves to enlarge the
openings, or dilate the passage through the alæ,
Hence it has been called by some anatomists the
Dilatans Nasi. The next muscle to be noticed is
one which runs down to be inserted into the corner
of the mouth this is called the

## Levator Anguli Oris

And arises from the superior maxillary bone just
below the infra orbitar foramen above the root
of the first molar tooth, It is a muscle of small
size and is inserted into the corner of the mouth
serving as its name imports to raise the angle of
the mouth upwards We have next an elevator
muscle of the upper lip and side of the nose, the

## Levator Labii Superioris alæque Nasi.

Beneath these muscles and around them you
see upon the subject, cavities and depressions

you must be careful that these do not lead you into error by supposing them to exist naturally, as these points in the natural condition are entirely filled up with fat and cellular tissue, which serves as stuffing through which the muscles work. This elevator of the upper lip and nose arises from two points by a long and short head, the first of which comes from the nasal process of the superior maxillary bone where it joins the frontal running down the side of the nose along by the edge of the lachrymal sack, The short head has a broader origin from the orbitar plate of the maxillary bone near the infra orbitar foramen, whence it proceeds straight down to be inserted into the upper lip with the long portion which in its progress is also inserted into the ala of the nose. The action of this muscle is of course to raise the upper lip and sides of the nose, As an antagonist to this we must have a depressor of the upper lip and nose which is therefore called the

## Depressor Labii Superioris Alæque Nasi,

This has its origin from the upper maxillary bone just above its junction with the incisor and canine teeth and is inserted into the upper lip and ala of the nose This lies just beneath the mucous lining of the mouth and is pale in colour, its action is indicated by its name The next muscles for consideration are those called the canine or snarling muscles they are the

## Zigomatici

There are commonly two of these called major and minor, but in the case before us they appear fused together being only divided near their insertion, They both arise from the malar bone the larger from near the root of the zigomatic process, and the smaller from the body of the bone more internally, from whence they run obliquely downwards and inwards to be inserted into the corner of the mouth, which they serve to draw upwards and outwards in a snarling manner so as to expose the canine teeth, We now descend to the muscles of the lower lip and first of them to the antagonist of the levator anguli oris, This is the

## Depressor anguli oris

This as it also antagonises the zigomatic muscles is in comparison to the others large and strong, It originates

from the lower edge of the inferior maxillary bone at the side of the Chin by a broad fleshy base, from whence it grows narrower and is inserted into the angle of the mouth to draw it down, We have also a

## Depressor Labii inferioris

This is a singular muscle from being very much intermixed with fat, and the roots of the beard which penetrate the integuments and are found coming from this muscle, It arises by a broad base at the side of the Chin in contact with its fellow of the opposite side, and is inserted into the edge of the lower lip extending for some distance, Its name implies that it depresses the lip. This has also an Antagonist otherwise the lip after being depressed would not readily regain its position; this is the

## Levator Labii Inferioris

Whose origin we find at the roots of the alveoli of the two lower incisors and sometimes of the ~~B~~cuspid teeth and inserted into the lower lip and skin of the Chin The fibres of this muscle are pale as they generally are when in contact with the mucous membrane, It may be asked how this muscle can elevate the whole mass of the lower lip by merely being inserted into its lower part, This is accomplished by the lip being made firm and consistent by the slight contraction of another muscle which we have now to notice namely the

## Orbicularis Oris

This like the orbicularis palpebra is a circular muscle, but unlike it is made up of a number of different fibres at different points of the ring, as it surrounds the most movable orifice in the body, It has two Commissures each of which give origin and insertion to the muscles which go to its formation which are properly a continuation of those which have their insertion at these points, By the action of this muscle the orifice of the mouth is varied in size, from that which produces whistling to the largest opening, being very movable. There remains one more muscle to be considered in connection with the mouth, this forms the middle portion of the Cheek and is

Called the **Buccinator**

from Bucca a trumpet as it is the trumpet muscle of the mouth by which the air or fluid is compressed and forced out of the mouth in a stream or jet. It fills up the space in the Cheek between the upper and lower jaw and has its origin from the lower jaw as far back as from behind the last molar tooth to and the from front part of the base of the Coronoid process, - also from the upper jaw between the last molar tooth and the pterygoid process of the sphenoid bone, by a fleshy attachment, - also from a white tendon which extends across between these points of origin by which it is continuous with the upper Constrictor muscle of the pharynx, From this extended origin the fibres run straight forwards in a converging direction to be in-serted into the angle of the mouth. It is important to notice the continuity of this muscle with the upper Constrictor of the pharynx as in the act of deglution the mouth must be shut to enable this muscle to contract and thereby draw up the pharynx to receive the bolus which is afterwards pressed down by these muscles. It also acts in ~~during~~ mastication by keeping the food pressed up from the outside between the teeth, in which it much aids the tongue, The act of whistling is also performed through the instrumentality of this muscle by which the air is forced through the narrow aperture. Near the middle of this muscle and opposite to the second molar tooth we notice a small orifice which piercing the mucous membrane opens into the mouth. This is the opening of the excretory duct of the Parotid gland. From this point the duct runs backwards over the masseter muscle to join the gland which lies in front of the ear extending from the root of the zygomatic arch to below the angle of the lower jaw, This duct by which the salivary secretion of this organ is poured into the mouth is called the Ductus Stenonianus from the anatomist who first described it, and lies in a line from the lower lobe of the ear to the roots of the incisor teeth of the upper jaw, This it is very important to remember in operations and accidents about these parts, in which a cut would result in an incurable or almost incurable fistula through

which the saliva would during mastication or at the sight of any luscious morsels, giving a great deal of inconvenience, There exist two other salivary glands which pour their secretions into the mouth upon each side of the frænum of the tongue, One the submaxillary may be seen here just under the edge of the lower jaw, — the other lies beneath the tongue and is called sublingual, — their position may be better seen by reference to these large drawing in which they are represented. One other muscle will now finish those concerned in expression, this is the

## Corrugator supercilii

or frowning muscle, This takes its origin from the internal ~~angular process~~ end of the superciliary ridge of the os frontis by a fleshy beginning, where it joins the nasal bones, and is inserted into the inferior portion of the occ-ipito frontalis muscle upon the superciliary ridge The action of this muscle is to draw the skin on the forehead into vertical ridges or wrinkles and give an austere and intent expression to the face, The principal or fundamental expressions which these muscles produce are three in number namely mirth, sorrow and fear, from the various combinations of which all the truly various exp-ressions of which the human countenance is cap-able, are made up. The first, mirth, is char-acterized by a slight elevation of the eyebrows, and drawing back the corners of the mouth by the buc-cinator and zygomatic muscles, A lighter action of which forms a smile, which by the action of the depressor anguli oris is made scornful, — Sorrow is principally expressed by the raising of the eyebrows, and the drawing down of the corners of the mouth, Fear is expressed by the wide opening of the eyes by the action of the occipito frontalis and levator palpebra, — and by the falling of the lower jaw and slight opening of the mouth, But as these come particularly under the notice of the professor of the institutes, I shall not go fur-ther into their anatomy, but at our next meeting after the holidays are over, we shall take up those of mastication and deglutition.

**Lect. XXX.** Jany 2.

I propose to commence to day gentlemen, with the consideration of the fascia of the Neck. There are two in number, a superficial and a deep seated, As we resect the skin from the region of the Neck, we bring into view, as in fact in every other part of the body, a layer of condensed cellular tissue for the purpose of allowing of free motion, and at the same time, a connexion of the adjacent parts, This is here termed the fascia superficialis colli, which is known to be but the continuation of the same envellope which covers the abdomen and thorax, as it goes up to give an envellope to the superior parts of the body, being attached to the base of the lower jaw, and to the zygoma, In some subjects this is found to be thick and strong whilst in others it is very thin, That which you here see is of about the usual thickness, although it is apparently much thicker from the deposition of adipous matter within it, which is generally present in fleshy or corpulent subjects, giving it a rough and thickened aspect. This is generally described as consisting of two layers, a deep seated and superficial layer, between which is found a small muscle interposed, When the external layer, which is here exposed, is turned off, we expose this, which from its form and situation has been called the Platisma Myodes or musculus cutaneus, lying between the two layers and in immediate contact with them, This external layer after covering the outer face of this muscle, ascends to give a like covering to the muscles of the face, after which it is lost in the general investment of the head, Further back it is attached to the zygoma where it as a thin layer becomes merged passes over in the strong temporal fascia which covers the side of the head, covering in all the muscles upon the side of the face and superficially also the parotid gland, The Musculus Cutaneus or Platisma Myodes which comes next in order has its origin from the cellular tissue which covers the Pectoralis Major and part of the Deltoid muscles having no bony connexion Scap: clavicle & Acromion whatever, In this it is peculiar and represents a class of this kind which is found in most animals to be very strongly devellopeed, by which the skin upon various parts of the body is rendered movable at the will of the animal for the purpose of removing anything which may be upon it.

Skin of neck very nice for plastic Surgery purposes

From this origin over the upper part of the thorax, we trace it up in a thin layer of fibres, over the side of the neck to be inserted by the intervention of cellular tissue to the ~~base~~ oblique line of the lower jaw in part, and in part by a prolongation of some of the fibres into the depressor muscle of the angle of the mouth heretofore described, and some of its fibres in a majority of cases, immediately into the corner of the mouth forming the musculus risorius of Santorini from the peculiar saturnine expression which its action gives to the countenance by drawing down the corner of the mouth. In consequence of its connexion to the chin this muscle will act as a depressor of the lower jaw in a slight degree, or acting together when the jaw is fixed by the muscles above, to incline the head forwards, - or singly, to one side. This muscle is sometimes though rarely found shortened by an inordinate and constant contraction as in other muscles, giving rise to deformity, by drawing the head down and to one side. This when it occurs may be remedied in the same way that ordinary club foot or torticolis is, namely, by a subcutaneous division of the muscle, and a subsequent mechanical treatment to keep the head erect. When the head is fixed by the muscles attached to it, a contraction of this muscle will draw up the integuments covering the thorax. When we turn off this muscle we notice the position which it occupied between the layers of the fascia, covering this which is the Sterno Cleido mastoid muscle and the whole side of the neck. When we turn off, as upon the opposite side of the subject has been done, the whole of the superficial fascia, we expose at once the Sterno Cleido mastoid muscle, and have included within the fascia the Platisma myodes, the fibres of which may be distinctly seen through the deep seated layer which separated it from the S.C. Mastoid muscle beneath, so very thin and delicate is this portion of it. Covering this S.C. Mastoid muscle beneath the fascia you see the external Jugular vein which is a continuation of the Temporal vein as it passes downwards to empty into the larger trunks. This as you will notice, passes from near the angle of the jaw, almost directly downwards, inclining a little backwards, and therefore

or by inserting a flap -

crosses the muscle in diagonal direction and proceeds to throw itself into the Subclavian trunk in the depression beneath or behind the Clavicle. The relative position and course of this vein is interesting to us principally from the necessity there sometimes is, from a difficulty in raising a vein in other parts &c of performing phlebotomy here, and it is in this respect quite important to have an intimate knowledge of the anatomy of the parts. We see in the first place that to open this vein we must cut through one of the ~~both~~ layers of the two [layers] of the fascia as well as through the fibres of the Plat-isma Myodes between them. The opening should in every case be made over the belly of the S.C. Mastoid muscle, as there is then little danger of opening an artery or cutting any very vital part, - and should be about two inches above the Clavicle. The direction in which the incision is made is also of importance, for if it be vertical or parallel with the fibres of the muscle, the contraction of these fibres may close the opening so as to prevent the issue of blood whereas if the cut be made by placing the Spring or thumb lancet obliquely to the course of these fibres, two or three little bundles of them will be cut, and the retraction of the divided fibres will give you a free opening through which the blood will flow without interruption. We find also beneath this fascia a number of small nerves running in various directions. These are merely cutaneous branches from the inferior Cervical nerves and perforate the fascia to be distributed to the integuments giving that sensibility which we know the skin here to possess. Some of the fibres however stop at the platisma muscle to give to it ordinary sensation and motion, but besides these it has, as we shall hereafter have to notice more particularly, some branches from the nerve of expression distributed to the face, namely the portia dura of the seventh pair. We next notice a large nervous branch crossing the S.C. Mastoid muscle nearly in the same direction but but a short distance from the external jugular. This is the Nervus Superficialis Colli and has the same general distribution with the other branches in the vicinity. We next come to notice the remaining fascia of this region, namely, the fascia profunda Colli or Cervicis. This from its surgical relations is of much more importance than the one just considered, and the modes of describing it are various, and many of them

too complex to facilitate a clear understanding of its situation and function. This deep seated fascia forms a part of the sheath of the sterno cleido mastoid muscle, as we have seen the superficial fascia do in reference to the Platysma — or as some say ~~and~~ this muscle therefore forms the separation between the superficial layer of the deep seated and the deep seated layer of the superficial the two coming together at the edge of the muscle. ~~to~~ The first view being the better & very easily shown when the fascia is well developed. This fascia extends across from side to side continuously, the division here made being entirely arbitrary. The chief point of connexion then between the two fascias is this inner edge of the S.C. Mastoid muscle. Some anatomists describe the one or the other as forming the entire sheath of this muscle, but I think this tends to make the demonstration more intricate. This deep seated fascia is also bifoliate or consists of two layers, the course of the more superficial of which we shall commence at the sternum and endeavour to follow up. This is a much stronger layer than either of those superficial ones which we have seen. It takes its origin from the sternum and clavicle above as well as beneath the origin of the S.C. Mastoid muscle and runs up covering the larynx and all the other parts contained in this region being fastened to the hyoid bone with a strong layer, and finally after covering the muscles which go to the tongue, has its insertion upon the base of the lower jaw. The origin of the sternal portion is directly from the upper margin of the first bone, and it is therefore quite fixed at this point. It is thinner where it runs under the S.C. Mastoid muscle, but quite dense and strong between the edges of these of either side. As we cut this up from its origin at the sternum, and turn it aside, we bring into view two beautiful ribbon shaped muscles upon either side of the median line which we must now take some notice of. ~~to~~ The first of these is the

## Sterno Hyoid

which is most superficial and has its origin from the first bone of the sternum and from the capsular ligament by which the clavicle and sternum are joined, from these points it forms a thin muscle and runs almost vertically upwards to be inserted into the base and a part of the cornua of the os hyoides. The two muscles of the opposite sides come in contact upon

the middle line of the neck and partly cover the two next which we must consider, The

## Sterno Thyroid

which is separated from the former only by some thin layer of Cellular tissue which goes to form a proper sheath for each, - has its origin lower down upon the inner edge of the upper bone of the sternum, say one inch below the first.
+ partly from the [illegible] cartilage of 1st rib
It is also upon the outside of the Sterno hyoid, leaving a considerable space between the two of opposite sides. This arrangement brings them somewhat from under the former muscles, so that their outer edges can be seen projecting free, they are also generally of greater breadth particularly in well developed subjects as the one before us, The situation and size of these muscles are of considerable importance, as the arteria innominata upon the right, and the primitive Carotid of the left side cannot be reached except by cutting some part of this muscle which lies immediately over them, This is quite an important feature in operations for the ligature of these vessels which is sometimes required at the points mentioned. As we divide this muscle from its origin at the sternum and dissect it up in the direction which it runs, you see that it covers the side of the trachea, larynx, and thyroid gland, and goes finally to be inserted upon the thyroid cartilage, by an oblique ridge upon its side, The origin and insertion of these two last considered muscles being nearly the same, their actions must accord in the same degree, This will be to draw down the Larynx and Pharynx too in as much as they are closely connected, and in this manner influence deglutition, Phonation is also very much affected by the action of these muscles, which by shortening the tube of the larynx, perform the same office or effect as that of opening a hole in a flute whilst the instrument is being sounded, This modification of voice by this means is very evident in watching a Canary Bird, or a Singer who has great command of voice, where many of the sounds are accompanied by this raising and lowering of the larynx that could not be otherwise produced, The lower constrictor muscle of the Pharynx as we shall hereafter have occasion to notice is inserted almost in connection with the insertion of this muscle, from which it must

necessarily aid in the office of deglutition, by fixing a point from which this muscle can act in the passing of a bolus of food down into the esophagus. After having seen and turned of successively the superficial layer and the muscles, we next come to the deep seated ~~fascia~~ layer of the profound fascia. This layer we find attached to the sternum below the origin of the muscles which are therefore contained in a small compartment as it were made by a separation of these two layers. This layer after being inserted upon the sternum is continuous with the cellular tissue forming the anterior wall of the mediastinum, and is made much thicker and stronger than any other portion of the fascia which we have seen. This is for the purpose of avoiding the pressure of the external atmosphere upon the trachea and great vessels during inspiration, as well as to exclude it from the cavity of the chest exterior to the lungs. We know that when the cavity of the chest is dilated, and an approach to a vacuum produced, the air has a tendency to force its way into this from any point, and here where the cavity was least protected, having no fixed barrier, it was necessary by some arrangement of this kind to guard against any difficulty in inspiration from this cause. When we cut through this layer we find lodged immediately below it the thyroid gland invested in its capsule, together with a quantity of fatty matter covering the parts and filling up the spaces, below these again we have the larynx above and the trachea below, and then the pharynx with the esophagus. Through the opening made in the fascia, you see that I can pass the knife handle immediately into the mediastinum. From this proximity you will see the serious nature of deep seated abscesses about these parts, in comparison with those of others, and the necessity there is for an early opening and evacuation of the matter before it should have burrowed under or pierced this fascia, in which case the pus would escape into the mediastinum and cause inflammation with fatal derangement of these vital parts. Early attention is therefore always proper more particularly to such affections of these parts, or to such as are liable to run into these.

We must next turn our attention to the course and situation of this the

## Sterno cleido mastoid.

About the neck there is various land marks as it were, like those which a sailor has, from which he calculates his bearing to others which are not visible, and the direction which he must take to come upon those for which he is in more immediate search, One of the most important of these is this muscle, as its prominent posi-tion renders it always attainable as a guide. It has its origin by two distinct slips, - the one by a rounded tendon from the upper bone of the sternum, and the other fleshy from the inner third of the clavicle, From these separated origins the portions unite to form this large rounded belly, which after proceeding in an obliq-uely backward and upward direction, is inserted upon the back part of the mastoid process and for about an inch upon the superior curved line of the occipital bone, leaving all the important vessels and nerves before it or between the two upon the front of the neck.

The action of this muscle would be if acting singly to draw the head around and downwards upon one side, or if both act in concert to throw the face upwards When the head is fixed by the trapezius and other mus-cles, these acting would elevate the ribs, and from this action they become forced muscles of inspiration for which purpose, as we shall hereafter see, they have a part of a particular nerve distributed to them, namely the spinal accessory of Willis, the remainder of which being a muscle of inspiration goes to the trapezius,

The diseased or unnatural contractions of this muscle is the ordinary cause of Torticolis or wry neck, in which being shortened the head is drawn to one side and down-wards, It becomes in some of these cases almost tendin-ous, and must be divided for the relief of the deformity The whole muscle is however rarely divided, it having been found that in a great majority of the cases, the sternal part was the only one at fault. The muscle being so prominent, this is divided with the greatest facil-ity, by making a small puncture through the skin with a knife upon the finger, withdrawing it without puncturing the opposite side. This should be done

at a point from one to one and a half inches above the sternum, It is necessary to observe however in connex-ion with the anatomy of this part, that a vein called the anterior jugular occasionally passes down the neck just under the edge of the muscle at this point, where it makes an angular turn to reach the subclavian or external jugular, in this case however there exists the anomaly of the connexion of this with the internal jugular just under the point, This vein though not always present is so in a majority of cases, and must be carefully avoided in the operation, It is a continuation of the fascial vein which also brings the blood from the tongue and adjacent parts, We next notice that this deep seated fascia where it extends outwards from the sheath for, and is connected to another muscle the

## Omo Hyoid.

to which I shall now call your attention, This muscle from an insertion into the hyoid bone has a fleshy belly extending downwards and outwards where it becomes tendinous, beneath the S.C. Mastoid muscle, this tendinous part is firmly attached to this deep seated fascia, from which it takes an outward and backward direction to be inserted as we shall hereafter see more particularly, into the scapula near the coracoid notch, The last men-tioned part is fleshy like the first, so that it is a true doubles bellied or digastric muscle, forming a kind of semicircle or half of an ellipse between its origin and insertion, Now the contractions of this muscle must of course tend to straighten it by shortening its course, and in so doing the deep seated fascia to which it is attached must be drawn up across the opening into the cavity of the chest, This I believe to be the true office of this muscle, namely that of a tensor to this fascia, by which it is kept in the proper position and condition, Its influence must also be felt upon the os hyoides into which it is inserted, having a tendency to pull this bone downwards and outwards, The remainder of these parts we shall have to defer the consideration of until our next meeting,

Lect. XXXI.

I mentioned to you yesterday gentlemen, that anatomists and operators who are not anatomists, have certain marks which may be found when the integuments are still covered by which they are directed in the use of the knife in the various operations about the neck, and that any one who undertakes these operations without being familiar with them is like a mariner at sea without compass or guide by which to be governed, and is as likely to go wrong as right in his direction. There are many of these marks which it is necessary to understand and which I shall point out to you, but the grand starting point is this Sterno Cleido muscle which in our study of yesterday, we found arising from the sternum and clavicle in front and going obliquely backwards and outwards to be inserted into the back of the mastoid process of the temporal bone. This I say is the grand starting point because it is prominent and superficial, and may be readily traced out by the eye or hand upon the living subject. The divisions and localities about this region I shall be enabled to point out more clearly by reference to these large drawings which I have had made for the purpose, the normal direction of the muscles and their relations being accurately retained. In the direction taken by this S.C. Mastoid muscle from the sternum to the mastoid process it crosses that of the great vessels of the neck in an oblique manner, the primitive Carotid artery being hid from view in the lower part of its course by the sternal end of this muscle, lying exactly behind the division into clavicular and sternal portions, where it cannot be readily reached except by splitting up this line of separation or by the division of the sternal portion, either of which may be done when it becomes necessary to operate here. The upper part of the vessels however from the oblique direction which the muscle takes is entirely exposed or uncovered by it, and may be cut down upon without interfering with it. In all this part of their course they lie quite superficially being only covered by the sheathes fascia and integuments, they may be felt pulsating here quite distinctly, and the late Lord Castlereagh taking advantage of this position, committed suicide by opening this artery with a pen knife, so that when found he was quite dead with only a small puncture in this part of the

neck, If we draw a middle or vertical line up the neck we shall form two triangles whose boundarys will be on one side the edge of the S.C.M. muscle, on the other this median line, and the base will be the base of the lower jaw, This is called upon each side, the great anterior triangle in contradistinction to one situated posteriorly and called the great posterior triangle, the boundaries of which are the posterior edge of the S.C.M. muscle, the anterior edge of the Trapezius, and the Clavicle. Through the ~~is~~ last triangle runs the external jugular vein to empty into the subclavian in the fossa ~~above~~ beneath the Clavicle; - in it there is but one operation of consequence performed, and that is the ligature of the subclavian artery above the clavicle, In the anterior, there are many operations of great importance, principally upon the Carotids in the different parts of their course, As according to circumstances, these operations may be necessary in different parts of the vessel, this anterior triangle is subdivided into three lesser ones, the first or Lowermost one is the inferior Carotid triangle and is formed by the median line, the inferior edge of the muscle which we last considered yesterday, namely, the omo hyoid, and by the edge of the sternal portion of the S.C.M. muscle, The second is called the superior Carotid triangle and is formed by the superior edge of the omo hyoid, - the inferior edge of the digastric muscle which we shall soon have to notice, and by the anterior edge of the S.C.M. muscle, The third triangle is called the submaxillary from its situation under the jaw, and is formed by the base of the jaw above by the upper edge of ~~the one~~ anterior belly of the digastric muscle below, and by the second or posterior belly near the middle line, These are the subtriangles formed out of the great one, and which I show you here upon the subject to corroborate the accuracy of the drawing, although the subject is not a very good one for the purpose, being short necked, the muscles are however well developed and full of blood, A repetition however will serve to impress them upon you, as well as to exhibit the accuracy of the representation which I have made from the large drawings, We will now turn off these muscles which we have already considered and proceed

to some other points to which we must give attention This deep seated fascia which we have now again exposed in proceeding backwards splits and after receiving the great vessels and nerve between its folds, again unites and proceeds on back to be attached to the transverse processes of the vertebra of the neck, Thus we see that the sheath enclosing these vessels and confining them to their proper places, is formed by this fascia in its progress. The vessels lie in this sheath in the following order,-the artery nearest to the middle line and the vein upon the outside, and the all important pneumogastric or Par vagum nerve as it was formerly called lies between and rather behind them, In this position the do not lie loose and simply en-closed between the splited fascia, but each has its separate compartment allotted to it and is confined there by thin membranous partitions of cellular matter extended across from one side of the sheath to the other, Just as though you took a tin tube and by running thin partitions through it divided it into three separate tubes, one of which is smaller than the others, By this arrangement the proper position and relations are preserved, so that we always know where to find either for which we look, This deep seated fascia runs not only backwards to be inserted into the transverse processes of the vertebra, but also extends upwards, in which direction it again splits for the reception of the submaxillary gland, which by this means gets a complete sheath or cap-sule to surround it and keep it in its place, After enclosing this it is attached to the base of the lower jaw all the length of it, extending also back behind the ramus of the jaw where it is continued across in the form of vertical plate to be attached to the styloid process of the temporal bone, This is called the vertical septum, and is the dividing par-tition between the lower part of the parotid gland and the submaxillary, along the free border of this vertical septum the superficial fascia is attached forming another junction between these two layers, As this partition is pla-ced vertically between the back and front portions of the base of the head, the muscles which go immediately forw-ard must of course pierce it in order to accomplish that object, and to these I shall now ask your attention, The first of these is one which we have had to notice incident-ally before, in speaking of the divisions of the neck, this

is the **Digastric**

so called from having two bellies in different directions of its course. The first or posterior of these arises from the digastric fossa behind and within the mastoid process of the temporal bone, from which it proceeds forwards and pierces the vertical part of the deep seated fascia in going to get an attachment to the os hyoides previous to which it becomes tendinous. This is a true attachment, and not as some anatomists have described it, a mere playing through a pully, being firmly connected by dense cellular tissue to the bone. From this point it again grows fleshy, forming the second belly and goes up nearly in a vertical direction to be inserted with its fellow of the opposite side into the lower maxillary bone at the symphysis. This muscle as will be seen, forms from origin to insertion a curved line or angle, which in its contractions must be of course lessened as the tendency will be to a straight line between the points, hence the os hyoides must be made to approximate the chin as well as be drawn somewhat backwards. Now to this os hyoides is attached the base of the tongue, which must therefore in a measure follow its motions, and when it is drawn up there must be a tendency to protrusion of the tongue from the mouth. In addition to this action it must, when the os hyoides is fixed by the muscles below, act as a depressor of the lower jaw, particularly, the anterior belly which is extended directly between the chin and this bone, this being probably one of its greatest offices, & if the chin be rested on a marble mantel, it will by its posterior attachment lift the head with the upper jaw from the lower, & so open the mouth — Before proceeding farther with those muscles attached to the lower jaw we must notice a small one which exists lower down, this is called the

**Thyro Hyoid.**

It appears upon looking at it to be a simple continuation of the sterno thyroid muscle which we have before considered, up to the os hyoides, but upon examination is found to arise from the thyroid cartilage near to the insertion of the sterno thyroid and to pass up and be inserted upon a part of the basis and cornua of the os hyoides. The action of this will of course be to diminish the space between the cartilage and the bone. Between these two there exists an elastic ligamentous membrane which under circumstances of necessity will permit a separation to some extent, which this muscle by being

placed here is calculated to govern, and reduce to a natural condition after having been separation. We will next proceed to a more accurate consideration of the position of the Submaxillary salivary gland the sheath of which we found to be formed by the ascending portion of the deep seated fascia of the neck, This gland we find placed as its name imports beneath and behind the lower maxillary bone, being entirely hid from view by the bone except in the strained back position of the head in which this subject is placed, which brings the surface of the tongue even, below the level of the base of the jaw as you may see by this instrument which is passed in onto the tongue, So that in the ordinary erect position of the head this gland is rather within them below the lower jaw bone, It extends horizontally from near the ramus to near the symphisis of the jaw being of a very considerable size, Lodged upon its outer side we have several lymphatic glands, generally numbering seven or eight sometimes nine and ten of them are found; these do not belong to the gland at all as it is salivary and these are lymphatic, and are merely placed here for convenience of position, These frequently become enlarged in scrophula, and in tonsilitis also they may generally be found to be enlarged by passing the hand under the base of the jaw, This is apparently an effect of sympathy, with the sore throat, They sometimes become schirrous and have in this condition been extirpated when the surgeon believed he was removing the sub-maxillary gland itself. From the inner and upper side of this gland we find the proper excretory duct, by which the secreted saliva is poured into the mouth. This is called the duct of Wharton from the anatomist who first described it and empties itself into the mouth to one side of the frænum of the tongue, This gland is covered in by muscles which are connected to the lower jaw so as not to be seen at until these are removed, the first of these is situated immediately above the digastric and is called the

Mylo Hyoid

from its forming the floor of the mouth which was compared to a mill, and having its attachment to the os Hyoides below, It takes its origin from the inside

of the jaw from as far back as the last molar tooth to the symphisis where it joins with its fellow of the other side, and is inserted into a part of the base of the os hyoides and into its fellow along the median line, This muscle always presents a slight convexity upwards, which is obliterated by its contraction, by which it draws up and to one side the os hyoides and increases the vertical dia-meter of the mouth, when the os hyoides is fixed it will of course draw down the lower jaw, To expose some other muscles which lie beneath or within this, it is necessary to divide it in the middle line and draw it to one side. In doing this we bring into view first, another salivary gland, seated as its name imports beneath the tongue, This sublingual gland is very often found as in this case, lobulated; it is of considerable size and may be seen beneath the tongue covered only by the mucous lining, its function like the other is to secrete saliva which is poured into the mouth partly by the duct of Wharton which passing immediately through it receives ~~many~~ many of its ducts, and partly by ducts emptying immediately into the mouth by the side of the frænum of the tongue, when this occurs as it sometimes does by one considerable duct it is called the duct of Bartholinus, The third salivary gland we have already noticed, and I merely bring it up again to complete the picture of the salivary apparatus, and to notice it somewhat more minutely, This is the Parotid gland, so called from its situation near the ear, This is much larger than the sum of the other two and occupies the space in front and bel-ow the ear from the zygoma down below the lobe of the ear to the ramus of the jaw and styloid process, dipping in between the muscles, and going in ~~to the~~ as far as the articulation of the jaw, This is therefore quite a large and important body, being spread over a considerable space, and made up of glandular substance in common with those ~~of the~~ already noticed, It function like theirs, is to secrete saliva which is poured into the mouth through a duct larger than a crows quill, which passes over the outer side of the masseter muscle, and empties itself into the mouth by piercing the buccinator muscle

near its middle as we have heretofore seen, This duct of Steno or Parotid duct as it is called is found on a line nearly, from the lobe of the ear to the tip of the nose. These three then constitute the whole of the Salivary apparatus whose secretions are thrown into the mouth, and in the agregate form quite a large gland. After turning aside the Mylo hyoid muscle and removing the sublingual gland, we expose another muscle called the

## Genio Hyoid.

This is a small muscle situated within the other, and arises from the inside of the Symphysis of the Chin in connexion with its fellow and is inserted into the base of the os hyoides below the insertion of the mylo hyoides. Its action will be to approximate the Chin and Hyoid bone, generally by drawing this bone forwards and upwards. When we turn this down we expose another called the

## Hyo Glossus.

This muscle belongs to the tongue of which it forms a proper part, It originates from the os hyoides and runs upwards and outwards to be inserted into the almost cartilaginous membrane covering the tongue. Its action will be that of drawing the tongue inwards and backwards by shortening it at its base, We next come to the consideration of a muscle which has played a great part in modern times, in the discussions with regard to the causes of stammering, This is the

## Genio Hyo Glossus.

It is a vertical fan shaped muscle, the two of which are in contact upon the middle line being within the genio hyoid and mylo Hyoid muscles. It receives its name from the points of attachment, and originates from a tubercle upon the inside of the Chin, beside the genio hyoid from which the muscular fibres diverge in the shape of a fan, the upper to be inserted into the upper part of the tongue, the middle, horizontally into the middle of the tongue and the lower downwards into the os hyoides, The action of this is no longer believed by any to be concerned in Stammering that being now known to be a ~~physical~~ moral rather than a physical defect, It however sometimes becomes necessary to divide it as I have been obliged to do on several occasions. This may be done by introducing an instrument after separa

-ting the muscles, and cutting it across at its origin. This op-eration being however very rarely required is one of very little importance. From the radiated arrangement of these fibres to their insertion it must be seen that their action will be varied entirely by the direction in which they act singly. Thus the superior fibres by their action will pull the tongue downwards and backwards, whilst the middle or horizontal ones will give it an outward direction, and the lower ones will draw up the os hyoides and consequently the base of the tongue and have a tendency to protrude the tip from the mouth. When some of the fibres of each of these sets act, they will tend make the dorsum of the tongue concave. There is one other muscle connected with the tongue, which comes from the Styloid process, previous to the consideration of which we will consider some of the other relations of this process. From it we have coming three muscles, and two ligaments the latter of which are merely parts of the deep seated fascia before described, one of these called the Stylo maxillary ligament runs to the angle of the lower jaw, another called the Stylo Hyoid ligament passes from the same point to the Hyoid bone, and is often found ossified, having in this case several cartilaginous points in it. These are merely for the purpose of giving strength to the process and an extended origin for muscular fibres as this is a very small process to give origin to three muscles. The

## Stylo Hyoid

muscle arises from the ~~point~~ front of the middle part of the process, and goes to be inserted into the os hyoides at the root of the cornu. This muscle is generally split by the Digastric muscle passing through it. its action would be to draw the bone backwards and outwards. The next in order is the

## Stylo Glossus

which from nearly the same origin & the stylohyoid ligament runs to be inserted into the side of the tongue which it would draw down and backwards. The third and last of these muscles is the

## Stylo Pharyngeus.

which from the root of the styloid process runs to be inserted between the upper and middle constrictors of the pharynx, into the side of the thyroid cartilage, which its action would tend to draw upwards

I have seen from the Stylo ~~Pharyn~~ process a muscular slip running from the mastoid to the inner face of the angle of the jaw – making a 4th Stylod muscle, which we might call Stylo-maxillary —

Lect XXXII.

Connected with the external ear, gentlemen, we have several small muscles which in man appear to be merely the representatives of what in many animals are strong and effective ones. Comparative anatomy shows that in many animals the ear may be turned in many directions by the volition exerted. In man however these are scarcely under the control of the will, although individuals are met with in whom the voluntary motion is appreciable. Posteriorly to the ear there exist generally two, sometimes three small muscles called

## Retrahens auris.

Which have their origin from the fascia which covers the mastoid process of the temporal bone, whence after forming small fleshy bellies they are inserted into the posterior part of the concha of the ears, These are very superficial being covered merely by the scalp and superficial fascia, their action of course would be to draw back the ear, Another muscle much larger than the last, and exceedingly well developed in this subject, who judging from the appearance of the muscle, must have had the power of moving the ear to a considerable extent by its means, this is the

## Attolens auris.

Or lifter up of the ear, and is seated above the ear upon the side of the head. This arises by a broad origin from the edge of the broad tendon of the Occipito frontalis muscle which passes over the head in this direction as we shall see hereafter, and goes to be ~~inserted~~ inserted into the upper part of the concha A third muscle or sometimes two muscles is found upon the anterior side of the ear, This is the ~~att~~

## Attrahens auris.

Or anterior auris as it is often called; This arises from the lower part of the temporal fascia in front of the ear and goes to be inserted into the anterior edge of the ear opposite to the concha, The action of this of course will be to draw the ear forward and antagonise the first muscle mentioned, These muscles are all of them much better developed than is usual this being a remarkably muscular subject, well calculated to display these structures. The next muscle to which I must draw your attention is one to which I have before alluded by a drawing, in the description of one to which we found it attached, This is the

## Occipito Frontalis

So called from its covering the occiput as well as the sinciput

as the ancients used to style the fore part of the head or that opposed to the occiput. This is a digastric or double bellied muscle, one of which is found posteriorly, the other anteriorly there are connected by a broad thin tendon which spreads like an aponeurosis over the top of the head. It takes its origin from the superior transverse ridge upon the occipital bone, partly by muscular, and partly by tendinous fibres, and after forming a short fleshy belly, becomes converted into silvery looking tendon which upon arriving at the fore part of the head becomes again fleshy, forming the anterior belly which is much larger than the posterior, and passes down over the forehead to be inserted into the Orbicularis Palpebra muscle as we have seen, and also sending down a portion called the nasal slip, along the dorsum of the nose, to be connected with the compressor Naris muscle. This nasal slip is sometimes described as an independent muscle under the name of Pyramidalis nasi. The action of this muscle will be to move the scalp backward and forwards, and it is this, under the effect of fear that thus moves the hair so as sometimes to make it almost stand on end, or even raise the hat from the head. It is by the action of this muscle that the skin upon the forhead is thrown into horizontal wrinkles and the eyebrows drawn up, so as to open the eyes to a great extent. Upon this action upon the eyelids it is that the operation of Hunt of Manchester is based, in which by the removal of a piece of the skin from the eyelid in a paralysis of this muscle, the lid is attached to the occipito frontalis and drawn up by its contractions. There are some other facts with relation to these parts upon the cranium that it is my duty to point out, before leaving the region. First, you will take notice that the scalp is very firmly attached to this occipito frontalis muscle and its tendon throughout, no appreciable motion taking place between them, but as I move the scalp the muscle moves also; below the muscle however lies a quantity of loose cellular tissue in which all the sliding motion takes, by this the muscle is attached to the peri epicranium a membrane covering the whole cranium of a dense fibrous and strong character. Now in blows or accidents where a portion of the scalp is removed, this muscle is always removed with it, as they are very difficult to separate, whilst the loose cellular tissue beneath

readily yields; therefore in all accidents and in operations as trephing, we come at once down upon this aponeurotic epicranium. All the vessels which render the scalp so vascular run in this cellular tissue, and it is for this reason that wounds about this region unite with a facility which sometimes astonishes the surgeon. Another small muscle to which I must now more particularly call your attention is the ~~Corrugator~~

## Corrugator Supercilii

This takes its origin from the internal angular process of the os frontis, at the inner commencement of the superciliary ridge whence running upwards and outwards its fibres are lost in those of the occipito frontalis and orbicularis palpebrarum, opposite the vertical diameter of the orbit. Its action will be to draw the skin towards the middle line of the forehead and throw it into vertical wrinkles constituting a frown. I must next direct your attention to the muscles of the jaws by which mastication is effected, having already exhibited those which are concerned in, or proper to expression. The first of these which will attract our notice is that large and powerfull one by which chewing is effected as far as the vertical motions of the jaw goes. This is called the

## Masseter

from its use in chewing, and consists of two separate parts one external, the other internal. The one arising from the zygoma for its whole length back to the tubercle, the other from the malar bone where it joins the superior maxillary, and from the whole lower edge of the malar bone. The fibres of these two portions vary in their direction, those of the first running downwards and somewhat forwards to be inserted into the base and angle of the lower jaw, – the other running somewhat backwards and downwards to be inserted into the ramus up nearly to the coronoid process, thus making a kind of crossing between the two sets. This is a very thick and strong muscle, has the fascial artery running over its lower part, and the duct of Steno from the parotid gland crossing its centre to get to the buccinator muscle which it pierces to get into the mouth. The gland lies immediately behind the muscle and partly over it, particularly the upper part which is sometimes separated and called the socia parotis. As I cut up the outer portion as may be readily done by passing the knife in between

The muscles of the human jaw are said to exert a force of 534 pounds – But how it is proved I don't know

them, we have brought into view the deeper seated portion where we can notice the different direction of the fibres and the different insertions of the two sets. By this arrangement the anterior fibres will give the jaw a forward direction, whilst those which originate posteriorly will act conversely, and thus give the teeth a sliding motion necessary in mastication.
We notice here too that these muscles are placed upon each side posteriorly where their greatest action will be exerted upon the molar or large teeth which are those chiefly concerned in mastication proper.
This muscle is often largely concerned in the production of that muscular anchylosis of the jaws occuring from a powerful contraction with loss of a disposition to ~~relax~~ relaxa-tion. When this is the case it may be divided either wholly or in part as it may be wholly or partly implicated. This operation many of the class saw me perform at the Hospital sometime since in such a case. The anterior part may be divided readily by passing a knife into the mouth and outside of the jaw until it has gone behind the muscle and then turning the edge outward and dividing it downwards without cutting the skin. - but the division of the whole muscle cannot be accomplished in this way. When necessary, this may be effected by making a puncture at the anterior edge of the muscle, and carrying the knife beneath it entirely back almost to the ear, then turning upon its edge and withdrawing it so as to cut without dividing the skin. It is however rarely necessary to cut more than the anterior part, as the other can generally be forced to yield. - Care is always necessary in this operation not to cut the facial artery which runs over the muscle at the base of the lower jaw in a direction towards the corner of the mouth.
The next point to which we must direct our attention is this strong dense fascia covering the side of the head called the temporal fascia. This arises from the temporal or semicircular ridge upon the side of the cranium, formed partly upon the occipital chiefly upon the parietal, and as far forward as the external angular process of the frontal bone.
This fascia is distinct from the ~~Pe~~ Pericranium, having its origin immediately from the bones and proceeding outwards to cover the temporal muscle which gets

its origin partly from it, as may be seen in turning down the fascia from its origin. Its great strength and density is also apparent as it is dissected up from the muscle the fibres of which must be divided in so doing. As we proceed downwards with the dissection we find the fascia splitting into two layers, the outer of which proceeds downwards over the zygoma to give protection to the mass of fatty matter which is usually lodged there, which like such collections in all other parts is very liable to inflammation and abscess, which if not freely and early opened will burrow under the fascia to the destruction of the surrounding parts. The other layer of fascia is attached to the inner edge of the zygoma and covers immediately the temporal muscle. We have now by a removal of this fascia brought into view the ~~temporal~~

## Temporal M.

The origin of which is from the whole of this temporal ridge before mentioned, and from the bones of the cranium within this ridge down to the zygoma, covering a part of the parietal, temporal, sphenoid, and frontal bones from the external angular process of the frontal in front, to the back part of the mastoid process of the temporal bone behind. From this extensive origin as well as from the fascia the fibres converge and pass under the zygoma to be inserted around the coronoid process of the inferior maxillary bone which they entirely cover in partly by muscular fibre, and partly by tendon. This is the snapping muscle of the lower jaw, and is found largely developed in dogs. Its action of course from being inserted upon a lever will be to close the jaws with a snap, the degree of power which it exerts being considerable as it is a large and powerful muscle it of course come aid in mastication only by bringing the jaws directly together, exercising no power by which they are moved upon each other in the grinding motion. This muscle is also liable to that peculiar change which will not permit of relaxation thereby aiding in the production of that kind of false anchylosis of the jaws before spoken of. In such cases, when necessary it may be divided very readily by inserting a small knife through a puncture in the skin just below the malar bone, at the anterior edge of the masseter, and passing it in behind the coronoid process, turn it upon its edge and cut outwards

This divides the muscle at its insertion so that as you see upon the subject any after motion of the jaw does not affect the muscle at all, The instrument used in these cases should always be probe pointed to prevent unnecessary injury to the surrounding parts, There are two other muscles which are greatly concerned in mastication to which we must now turn our attention These are the

## Pterygoids.

or grinding muscles, These are two in number, one external, the other internal, and are placed deeply at the side of the face, To reach them we must cut away the masseter and temporal muscles and saw through the jaw at its base in such a way as will permit its being turned off as upon a hinge, In this way both muscles are exposed, and we find them large powerful ~~muscles~~ and well developed, The external one has its origin from the external plate of the pterygoid process of the sphenoid bone and from the adjoining portion of the superior maxillary, and also from the portion of the sphenoid bone, from whence it runs backwards and somewhat outwards to be inserted into the neck of the lower jaw, Its action would be to carry the lower jaw ~~outwar~~ forwards and inwards, in the grinding motions, The Internal pterygoid arises from the whole fossa between the plates of the ptery-goid process. being lined upon the inside by the mucous membrane of the mouth, From this origin it goes to be inserted onto the angle and ramus of the lower jaw, to pull it back after having been protruded by the former muscle, This is a more powerful and larger muscle than the first, and like it aids in the grinding motions of the jaws., The situation of these muscles is well seen upon this handsome preparation which however is not exactly accurate with regard to the direction in which the internal muscle runs, being represented as running to far back.—

We must next pay a further attention to some parts about the neck, and first to the position of the Thyroid gland, The muscles we have left attached here about the neck for the purpose of recomposition for an examination by synthesis as well as by analysis is usefull in giving full weight to the impress

-tions made upon the mind. As we turn off the Sterno Hyoid and Sterno Thyroid muscles, we encounter a small body upon each side of the trachea connected upon the middle line called the Thyroid gland, from its proximity to the thyroid cartilage, called a gland improperly however, as it has no excretory duct which has ever been discovered, and its use in the economy is entirely unknown, but supposed from its greater development at that time to be important to foetal life. It consists of two lobes, separated at the top by a crescent shaped notch. These lobes are connected together by a band called the isthmus of the thyroid gland, which in this case is very narrow and would form no obstacle to the operation of tracheotomy in this region, in which it is generally avoided on account of the necessity for cutting this isthmus if it should be of ordinary size, whereas it sometimes extends as high up as the second ring of the trachea, which is generally the top of the gland. In the necessity for operating here, it may be done by tying it up before cutting. This body is very vascular appearing when injected to be almost wholly composed of vessels, - having only a very limited cellular arrangement. We find the large vessels of the neck consisting of the internal Jugular veins the primitive Carotid arteries and the Pneumogastric nerve in their sheath running up by the side of this thyroid gland, sloping slightly backwards. These primitive Carotid arteries arising upon the right side from the Arteria innominata, upon the left from the arch of the Aorta, together with their branches must now receive some attention. These common Carotids when the head is thrown back run nearly a straight course between the fossa behind the inner end of the clavicle and the angle of the lower jaw before reaching which however they bifurcate and are divided into external and internal Carotids. The primitive trunks give off no branches as a general rule until they bifurcate which ordinarily takes place on a level with the upper edge of the Thyroid Cartilage. This however is varied in different subjects, - in the one upon the table which has a very short apoplectic neck this division takes place opposite the os Hyoides. After the division we find the external Carotid nearest to the median line of the neck and the internal, upon the outside, they being named from their distributions rather than from the first part of their course. The one going finally to supply the inside of the head and brain whilst the other is spent

upon the neck face and outside of the head. From the external Carotid we have a great number of branch-es coming off during its course, the first of which is the superior thyroid artery which runs across the neck to the thyroid gland, over which, and into which it sends a great many branches, some of them anastomosing with others from the subclavian artery. One branch it usually sends off, which is absent in this subject, crosses the thyroid space, and interferes with the operation of laryngotomy at this point as proposed by Vicq d'Azyr, in cases when there is not sufficient time to perform the lower operation. This under such circumstances might be done by tying the artery before opening the larynx, otherwise the blood would enter and interfere with the respira-tion. We find in connexion with these arteries and bra-nches some nerves which it may be well to notice at this time, And first of these to one which makes a deep loop down into the neck in this region. This is that nerve which we observed last in our ex-amination of the cranial nerves, coming out through the anterior condyloid foramen of the occipital bone passing down between the internal carotid and the internal jugular vein, crossing the external carotid. This Hypo glossal nerve is then distributed to the tongue of which it is the proper motor nerve. At the point where it crosses the external jugular vein it sends off generally a branch called the Decendens noni which passing down with the great vessels is dis-tributed to the Sterno Hyoid and Thyroid muscles for the purpose as is supposed of associating them in action with the tongue in phonation. This dec-endens noni is joined before arriving at its point of distribution, by a branch from the common superf-icial nerves which supply the muscles about the neck. This is called the communicans Noni, and gives to these muscles the ordinary nervous influence in common with other muscles of the parts. Thus we see that these little muscles are supplied by two distinct sets of nerves for the performance of their functions which cannot therefore be very unimportant, having the power to act either separately or in concert with the tongue in phonation.

Lect. XXXIII.

We have already seen that the primitive Carotid artery divides in the upper part of the neck into two large branches the one of which goes to supply the external whilst the other is distributed to the internal part of the head. We have also seen that the external trunk gives off many branches, one of which decends to supply in part the Thyroid gland, being called the superior Thyroid artery in destinction from the Inferior Thyroid which comes off from the subclavian, of equal size, the distribution of which is also the thyroid gland where it anastomoses with the superior by large branches. We have seen also that this superior thyroid sends two branches across the neck, one between the thyroid Cartilage and the os Hyoides, and the other across the cricothyroid space. These branches are quite large and dip in to supply the larynx, the lining membrane of which is known to be very vascular. The number of branches given off by the external Carotid is generally six, this rule however being liable to great variations, one of which we have before us, where the two branches which usually come off next in succession, arise by a common trunk which is afterwards divided into two branches. These are the proper Lingual and Fascial arteries the lowermost of which generally comes off first from the main trunk when such is their origin, This is the Arteria Lingualis, In following the course of this vessel we find it going slightly upwards and inwards to the Cornu of the os Hyoides which it crosses, and is afterwards covered by a muscle heretofore described, namely, the Hyo glossus, - turning down which we find the artery very soon becomes imbedded in the tongue to which it is principally distributed, It is important to notice the position and relations of this artery in its course, as in operations about the tongue, and in accidents it sometimes becomes necessary to tie it in some part of its course. This may be done in the first part of its course as it passes over the Cornu of the os Hyoides, or even in the second part, by turning up, or dissecting through a portion of the Hyo glossus muscle, After getting into the substance of the tongue it divides generally into three branches, one large one runs upon the side of the under surface and
+ is called the Ranine branch, sending off perpendicular branches in its course to the lower surface of the organ until it finally terminates at the tip. In the cases of
+ elongation of the fraenum which are often met with in

Children and have to be divided, we may readily con-ceive that this branch may be divided, and thus as it has sometimes done, give rise to a very troublesome degree of hemorrhage which it is difficult to arrest, particularly in children, in whom the accident most frequently occurs. Besides the main or Ranine branch which we have just described, there are two others, which also distribute their blood to the structure of the tongue and its appendages, the next one to notice is much smaller and comes off superficially beneath the tongue to supply the sublingual salivary gland, and is hence called the sublingual branch a branch from which running forwards upon the inside of the jaw, has been sometimes cut in the operation of dividing the genio glossus muscle for cases of stammering, - this however is not now important, as the operation is now among the things that are past, known only in history, Another branch is given off from this artery, which goes to supply the dorsum of the tongue and is called from its distribution Dorsalis Linguae, This branch in the subject before us is smaller than ordinary, whilst the Ranine is larger, thus making a compensation between the two, - and is distributed to the whole side of the dorsum of the tongue forming minute anastomosis with the other branches, Thus much for the Lingual branch of the external Carotid, and we next proceed to the consideration of the Fascial branch which is somewhat larger, and as before noticed comes from a common trunk with the lingual in this subject, although generally having an independent origin from the main artery. This artery from its origin ascends to the base of the jaw over which it mounts to attain the face, just in front of the masseter muscle where it may be generally felt, Before getting to the base of the jaw however, it gives off a branch which goes to supply the pharynx and is called the pharyngeal branch, And as it passes through the back portion of the submaxillary gland it also gives off a number of branches to it, all however being of small size and given off in the substance of the gland, The Artery then makes a curve around by which it mounts over the base of the jaw, surrounding it as it were, It is at this point where the

vessel crosses the bone, that compression may be made so as to control any hemorrhage that would otherwise supervene upon operations about the parts. This compression is made by placing two fingers under the base of the jaw over the place where the artery passes up, and this should be done upon both sides as the anastomotic communication is very free between the vessels of opposite sides, and the bleeding would not be controled otherwise. Just as the artery is about ascending over the bone it sends off a branch which runs under the chin and is therefore sometimes called the sub-mental branch, but from being chiefly distributed to the mylo hyoideus muscle upon which it runs, it is most generally described as the Mylo Hyoid branch, being not very large, and often presenting varieties this branch is of no very great importance. After piercing the back part of the submaxillary gland, and mounting onto the face in front or over the anterior part of the masseter muscle it takes an upward and forward direction towards the angle of the mouth. It is here accompanied by the facial vein which lays posterior to it about ⅛ of an inch. These vessels being here very superficial, covered only by skin fascia and ~~superficial~~ the Platisma Myiodes muscle are from this exposure liable to injury from accident, giving rise to very serious consequences. My friend Dr Randolph ~~Barton~~ had a case in which a punctured wound involved both these vessels although there is a space between them, and gave rise to a passing of the arterial blood into the vein and down to the heart, and produced so much disturbance in the circulation that although the carotid was taken up, it did not have the effect of remedying it as the patient ultimately died. Thus this kind of Arterio venous aneurism is always to be apprehended in these wounds of both the vessels which takes place with facility in these exposed situations. This is the position in which this artery is sometimes tied in cases of hemorrhage, and may be done without difficulty from its superficial situation. In looking at this artery as it passes over the face we are struck with its tortuous course, being twisted spirally or in zigzag direction from the jaw up to the commissure of the mouth. The object of this is very apparent, as it is found around all the joints and in every part where much motion is exercised. If this lengthening of the vessel did not occur, we should, in old age when the coats often become somewhat firm and brittle, be constantly liable to

have them torn in the motions of the parts, thus if the artery was just of sufficient length to reach from the base of the jaw to the corner of the mouth, a depression under such circumstances of partial ossification would be sufficient to break it across by pulling upon it. These several duplications as it were, however, prevent by giving plenty of length, the occurrence of such stretching. In passing by the masseter muscle this artery sends a branch for its supply which enters the muscle about its lower third. The next branch given off in its passage to the angle of the mouth is one of some size and is called the inferior labial artery from being distributed to the lower lip and the muscles which move it. As it approaches the corner of the mouth a branch of small size is given off to pass around the mouth below, this is the inferior coronary, and is generally much smaller than the superior, just above this another branch, the superior coronary is given off. this is quite large and goes across within the upper lip to which it distributes small branches, to form a direct anastomosis by its trunk with its fellow from the opposite side. This is the artery which is divided in the operation for hare lip, when it gives rise to considerable hemorrhage which however is generally arrested by the pins being passed through at the bleeding point. This hemorrhage is peculiarly troublesome in some cases when the operation has been put off until adult life, when as you see the artery is of very considerable size, and often requires considerable effort to stop. In all these cases it will of course bleed from both ends alike as the vessel is continuous upon the two sides. A number of smaller branches of this facial artery are given off to the cellular substance and integuments around its course through the face. After giving off this superior coronary the artery proceeds on upwards by the side of the nose giving a small branch to the nostril and edge of the ala nasi, called the lateral nasal branch, after which the main trunk passes on in a nearly vertical direction, sometimes being very small, up to the root of the nose, and thence onto the forehead to anastomose with the anterior temporal artery, distributing branches however along its course to the muscles of the nose and forehead. As it passes

upwards by the internal Canthus of the eye it takes the name of the Angular Artery, which it bears for the remainder of its course. It is upon these angular arteries that we rely in the plastic operation for restoring the nose from a flap taken from the forehead, they must be left to supply the flap with arterial blood, and a pedicle ¾ of an inch wide which is usually left at the root of the nose contains both of these arteries, Many of the celebrated surgeons of the day who are distinguished for their plastic operations, as Liston and Dieffenbach, say that when both these are left the flap is supplied with too much blood, becoming congested from that cause and therefore less likely to succeed, but in the operations which I have repeated several times I have never seen any bad effect arise from leaving both as I invariably do, there being no appearance of congestion in any case a half an hour after the operation, when the circulation has had time to become restored, And I attribute my great success, (for I have not as yet failed in any case) to this careful attention to get the sufficient supply of arterial blood to promote immediate union. This facial artery in its course which I point out to you upon this large drawing, is hid from view in a part of its course over the face as it dips under the zygomatic muscles and becomes deeper seated, I would next direct your attention for a few moments to the facial vein, which as you see takes a more direct course than the artery, going almost straight from the angle of the eye to near the angle of the jaw where it passes over, This receives a great many branches from the face and particularly from the lower eyelid, being so numerous here as to give a blue appearance to this part when they become congested as often occurs, indicative of disorders of menstruation, in females, A varicose condition of one of these veins which I saw with my friend — gave rise to so much difficulty that it could not be cured until the vein was opened and the clot which had formed was turned out, We must next turn our attention to another branch of this external carotid artery which usually comes off from the trunk next in succession, This is the Inferior Pharyngeal, which however is absent in this subject, being represented by the Pharyngeal branch which comes off from the facial, This is usually a small trunk

distribution to the upper part of the pharynx and the surrounding parts. The next branch requiring our attention in proceeding upwards with the main trunk, is one which goes to be distributed to the posterior part of the ear and is therefore called the Posterior Auris. This soon after its origin divides into two branches, one of which called the Stylo mastoid artery, passes in through the stylo mastoid foramen to the Tympanum ~~of the~~ passing through the aqueduct of Fallopius. This branch supplies the internal parts of the ear with blood. The posterior Auris after giving off this branch, passes up behind the ear where it gives of a number of branches to the external ear and finally passes up upon the side of the head to inosculate with the post-erior temporal or occipital arteries. This is generally a small artery and may be felt pulsating behind the ear. We next come to one larger, and of more importance than the last namely the occipital art-ery. This proceeds from its origin in the external caro-tid immediately up to the depression behind the mastoid process of the temporal bone, where there exists a ~~[illegible]~~ groove in the surface of the bone for its lodgment. This is called from the artery the occipital groove, and was exhibited to you when we were studying the bony structures. This artery as you must see lies very deeply at this point being covered by the integuments and the insertion of the Sterno Cleido-Mastoid muscle, conseq-uently being out of reach either of accident or operation, being covered also by the Splenius Capitis. It however in its course between the Splenius and Complexus muscles gets to be more superficial and turns up to supply the muscles upon the head and the scalp where after proceeding forward and distributing many branches, it finally anastomoses with the temporal artery. A bra-nch from this vessel is sent down upon the muscles of the neck ~~and~~ is called Arteria Princeps Cervicis. It sometimes becomes necessary from accidents &c to tie this artery in order to control hemorrhage, this may be done where it becomes somewhat superficial within the edge of the trapezius muscle by an opening in a nearly horizontal direction, across from the cranium in the direction of the transverse ridge upon the occip-ital bone. This artery sends off many small branches

to the various muscles in its course and also to the scalp which behind the ear and over the mastoid portion is supplied by the posterior auris, which as we have seen also supplies the pinna of the ear, These make up the whole of the branches coming off from the external Carotid, and their points of distribution, and we have now to trace out the main trunk as it continues up lessened greatly of course by the number and size of the branches given off. This ascends the neck through the middle of the space between the mastoid process of the temporal bone and the angle of the lower jaw, about half an inch in front of the auditory meatus, This artery sometimes runs over the parotid gland but often through its substance at least for part of its course, It may generally be felt pulsating in front of the ear although it is not as superficial as this would lead us to suppose, As it approaches the zygoma in its upward course, it bifurcates, or forks, one of the branches plunging through to get upon the inner side of the lower jaw and hence called the internal maxillary artery, before the division however, the main trunk sends off an artery which I have before mentioned and pointed out as coming from the midst of the parotid gland. This is the transversus fasciei artery and runs transversely across the face to anastomose with the fascial, The remaining division of this trunk passes up across the zygoma and becomes the proper temporal artery This Temporal Artery we see is ~~[illegible]~~ accompanied by its appropriate vein which after crossing the zygoma always enters the parotid gland and becomes there external jugular; so that you see, in the operation by which we attempt the removal of the parotid. this vein must be obliterated, You may here see again the course of this external jugular down the neck, and also see the manner in which the anterior jugular is formed by the facial after crossing the lower jaw, This instead of going towards the edge of the S.C.M muscle downwards sometimes goes backwards and empties directly into the external jugular, - and often as in the present case we have a large branch of communication passing between the two, The relations and anomalies of these veins should be known to you as you may thereby account for not being able in some cases to raise the external jugular sufficiently for the purpose of bleeding, - the blood being all carried off by a communicating branch

which joins this anterior jugular. Anomalies here are very numerous, seldom finding two cases in succession with exactly the same distribution. As the temporal artery from its superficial and exposed position is liable to be wounded, it is necessary to know where to find the trunk and how to take it up. It is as before mentioned always to be found about half an inch in front of the external meatus of the ear where it may be cut down upon and tied without any difficulty. During the first part of its course it sends off a deep branch called the middle temporal artery which supplies the temporal muscle, and the deep seated parts. This is often very small and is entirely absent in the subject before us. After proceeding a little further in its course the main trunk divides again into the anterior and posterior temporal arteries. The anterior runs outwards upon the forehead and is very superficial, crossing over to anastomose with its fellow and with the angular artery where it comes upon the forehead. This is the artery which is opened when a sudden and marked impression is to be made by blood letting. This should always be done here rather than in the main trunk as there might there be more difficulty in arresting the blood. In this anterior artery it is only necessary when enough blood has been taken to divide the artery entirely across, when the retraction of the extremities will stop the flow. - or it may be done by placing a compress not over the orifice, but a little below it upon the artery. If the operation is performed in the larger trunk the ligature must be used to stop it after enough blood has been taken. The posterior temporal artery is about the size of that just described and runs off from it at an angle, its course being more posteriorly, where it anastomoses with the branches of the occipital, after having sent out a number of branches to the scalp and cellular tissue. We have now finished the distribution of the external carotid artery with the exception of the internal maxillary branch which will occupy us at the commencement of our next meeting. The operations for the ligature of these various branches I propose to show you at one of our evening meetings

Lect. XXXIV.

We have yet remaining, one branch of the external Carotid to trace out to its distribution, before having finished the consideration of this trunk and its various distribution. This you will recollect I pointed out to you as the internal maxillary from its principal distribution. We noticed at our last meeting that in the substance of the parotid gland, the trunk divides one branch we traced up to form the anterior and posterior temporals and be distributed upon the integuments of the cranium. The other with which we are now concerned dips immediately down turning around the neck of the lower jaw bone to be distributed as the internal maxillary artery. This artery makes its first curve to get around the neck of the bone near the condyloid process where it is received into the glenoid cavity, - after which it gives off two main branches the greater and lesser arteries of the Dura Mater through their special foramen to the inside of the cranium. After this it makes a second curve into the pterygoid fossa where it gives off several muscular branches, which will be better seen upon the enlarged drawings which I shall exhibit to you. After leaving this, it branches in various directions to supply the whole lower jaw, and a portion of the upper. Upon this large drawing which has been copied from nature, I may show you the three points more clearly than upon the subject where they cannot be well seen at a distance. To commence then with a more minute examination of the branches of this trunk, we find it sending off first a small branch called the tympanic which passing through the glenoid fissure is distributed to the internal ear. Next we have the two arteries of the dura mater given off, and first of these the lesser which after getting upon the inside of the cranium through the foramen ovale, is distributed to the dura mater in the lower part of the cavity. Then we have the great or middle artery of the dura mater a quite large branch, which passes directly to the foramen spinale of the sphenoid bone through which it gets to the inside of the cranium and ascends the side to be distributed to the dura mater principally upon the sides and top of the cranium. You have seen when studying the bones, the grooves which these arteries have in them, being always placed upon the outside of the dura mater and between it and the bone. From this you will perceive that when ruptured by any accident the blood is effused between

the membranes and the bone and not upon the brain,
In this dried preparation the position and distribution of this artery are very well shown as the bone has been removed leaving the vessels and membranes perfect,
You notice that the artery divides into a large anterior and posterior branch by which the distribution is extended in these directions. The next branch given of separates itself about an inch from the origin of the main trunk and is the Inferior maxillary or Dental artery, It passes down between the internal pterygoid muscle and gets to the groove in the inside of the lower jaw where it passes into the substance of the bone after giving off some small muscular branches near its origin, Within the bone this artery in proceeding forwards gives off numerous branches to the teeth and finally divides at the anterior or mental foramen sending one branch still forward to supply the remaining teeth and bone, and to anastomose with its fellow, the other passing out upon the chin anastomoses with the vessels there and is distributed to the surrounding parts,
After this there are given off a number of branches say 5, to supply the various muscles around, these are irregular and small and not of very great importance, One passes to the Buccinator and zygomatic muscles, and another to the masseter, some other small ones to the pterygoid muscles as the artery is here lodged between these two,
There are generally two branches given off about this point which are called the deep seated temporal arteries as they run upwards to be distributed between the temporal muscle and the bone, lying as may be seen upon this dried preparation immediately upon the surface of the bone, One of these sometimes sends a branch to the orbit,
The next branch is the Superior dental or Alveolar artery This branch comes around the tuberosity of the upper jaw and sends branches to the surrounding parts as well as to the bone and gums, - branches from it pierce the upper maxillary bone getting upon the inside to supply the molar teeth, as the main branch lies upon the outside of the bone, Another small branch arises from the artery just below the zygoma, and soon after enters the infra orbitar canal between the two tables of the floor of the orbit, This is the infra orbitar artery, and

emerges upon the Cheek through the infra orbitar foramen, after which it spreads over the Cheek to supply the muscles, and sends branches down to supply the bicuspid canine and incisor teeth anastomising with the superior dental, The next branch is quite large and is called the Superior palatine which passes through the posterior palatine Canal and foramen to be distributed to the soft and hard palate and throughout the roof of the mouth. The next in order is the Pterygo Palatine which is smaller and is distributed to the upper part of the pharynx and adjoining structures, sending off a branch through the pterygo palatine foramen called the vidian, to be distributed to the parts upon its route, The artery then divides after becoming the Spheno palatine or lateral nasal and passing through the spheno palatine foramen is distributed to the septum and walls of the nostril, Upon this large model we are enabled to trace out the intricate distribution of this artery better than upon the subject, showing very clearly its anastomosis with the facial and other surrounding branches, Notwithstanding its large size and close distribution, we are enabled to cut through these parts with impunity, tieing the branches as they are cut always having as a last resort, the means of arresting the hemorrhage by tieing the external or common Carotids,

Upon this more elaborate preparation you may perceive that each of these arteries has its corresponding vein which converge and generally terminate in the external jugular as it descends the side of the neck, We have now to turn our attention to the remaining muscles of the neck, having noticed those which are placed superficially and are of the greatest importance in a surgical point of view, We have seen that from the Styloid process there came off three small muscles one to the Hyoid bone another to the tongue, and one also to the pharynx, To these I call your attention again, particularly for the purpose of showing you in connexion with them a small nerve which passes near them, this is a branch of the ~~Hypo~~ glosso pharyngeal, As we cut off these small muscles from their origin and remove those parts which we have already studied we bring into view a muscle which is of little importance except in a physiological point of view, from having the great Sympathetic nerve running down upon its edge, having upon this part of its course the superior and middle cervical ganglions, This muscle is called the

Longus Colli.

and arises from the three upper dorsal vertebrae by the sides of their bodies, and from the transverse processes of the third fourth fifth and sixth cervical, near their roots, being inserted into the fore part of the bodies of the whole of the vertebrae of the neck. The action of this muscle will of course be to bend the neck somewhat forwards and to one side, or both acting directly forwards. We have noticed some small muscles which being seated upon the back part of the neck had the effect of drawing it backwards, and we now must notice their antagonists upon the front part, the first of these is the Rectus capitis anticus major. This arises from the transverse processes of the third fourth fifth and sixth vertebrae of the neck and is inserted into the occipital bone just in front of the condyloid process. There are also two others of these small straight muscles, the

Rectus capitis anticus minor

which arises from the body of the Atlas or first vertebra and goes to be inserted outside of the former muscle upon the root of the condyloid process of the occipital bone. -and the other the

Rectus capitis Lateralis

arises from the point of the transverse process of the atlas and is inserted into the os occipitis opposite the Stylo mastoid foramen. All these muscles tend by their actions to bend the head forwards and to one side, in thus antag-onising the recti and obliqui which we found upon the posterior part of the neck, they are interesting only as regards their uses, never coming into any of our practical consideratic-ties. This completes with the exception of those proper to the Pharynx and Larynx, all the muscles about this region with the other exception however of those which we must now consider, which are of great surgical importance on account of the relations which they bear to some of the most serious operations in surgery. These are the three Scaleni or triangular muscles of the neck. The first or

Scalenus anticus

or anterior from the position which it occupies with rela-tion to the others, arises from the transverse processes of the fourth fifth and sixth cervical vertebrae and passes downwards and forwards in the form of a triangle to be inserted by its apex into the first rib at a small tubercular rising which exists there inside the groove for the subclavian artery. ~~near~~ the Cartilage. This point

being always perceptible in an operation upon the living subject serves to guide us to the insertion of this muscle, which is the point just within at which the Subclavian artery passes over the first rib to gain the axilla, The artery here makes a groove in the bone in passing over it, and may be compressed against it so as to control any hemorrhage taking place from its branches. This is the point also at which the operation for the ligation of the vessel above the clavicle is performed, it being the point at which it is most accessible. The Action of this muscle when the head is fixed will be to raise the ribs, and when the thorax is fixed it will bend the neck, Crossing in front of this insertion and immediately beneath the clavicle we have passing the great vein formed by the junction of the subclavian and internal jugular, Thus we see that this muscle always separates the vein from the artery at this point of their course, before reaching which however they are nearer to each other, the vein being constantly below the artery, lying in such a manner as not to be endangered in the operation if its position is known and avoided. After passing the scalenus, the subclavian vein on the left side runs along the inner border of the first bone of the sternum and becomes the vena transversa, or left vena innominata, until it finally joins its fellow of the opposite side and they ~~with the internal jugulars~~ junction goes to form the descending Cava which as you know opens into the ~~left side~~ right auricle of the heart. Behind this Anterior Scalenus we find another the

## Scalenus Medius.

This has its origin from all the transverse processes of the neck with the exception of the first, I think and is inserted into the first rib between its mid-dle and tubercle, nearest to the latter point, Anterior to this between it and the other, we have passing out the roots of the brachial plexus of nerves which go to supply the arm, as well as the great artery just spoken of. Posteriorly to this again we have another scalenus which is by many described, and may with propriety be considered as a part of the preceding muscle, The generality indeed of French anatomists describe but two Scaleni muscles the anterior and posterior considering this to belong to the middle which is then the posterior one This is the

## Scalenus Posticus

and arises from the transverse processes of the fifth and sixth vertebra of the neck and is inserted into the

upper edge of the second rib near the spine, We have noticed the distribution of some of the nerves of the neck and may now take a view of some of the origins. We have here first what is called the superior or posterior cervical plexus the roots of which come from the upper part of the spine This supplies all the muscles upon the back of the neck and sends some branches as we shall see hereafter to the occiput and cranium. Thus we have running up upon the back part of the head this which is the occipitalis minor, and again a little anteriorly to this the auricularis magnus to supply the external ear and the surrounding parts of the integuments, and then the superficialis colli which we have before seen crossing the sterno cleido mastoid muscle near the external jugular to be distributed to the adjacent parts. All these come from the superior cervical plexus, and are all subcutaneous. The Brachial plexus which we notice below, is much larger and is formed by the junction of the fourth fifth sixth and seventh cervical and the first dorsal nerves which divide and unite in such a manner as to form the plexus here seen which furnishes the nerves to the arm and shoulder, We have next to notice some muscles situated upon the upper part of the chest, and first of these the the large broad one which covers almost entirely the whole side of the thorax This is the

## Pectoralis major

This lies in connexion with the deltoides upon the upper and outer portion of the chest. the two giving all that rounded contour to these parts, It is one of the most powerful muscles in the body, and is divided into two parts by a fissure which in lean subjects often presents a considerable opening, but which in such a subject as that before us is hardly to be detected, It is of importance to notice this line of division for in it is performed one of the operations for ligature of the subclavian below the clavicle, - This cleft divides the muscle into a clavicular and a sternal portion and extends or may be followed entirely to the insertion, The clavicular portion arises from the inner 2/3 of the clavicle, which from being in a good formed man say 6 inches long, would give to this muscle a space of four inches for its origin. The sternal portion comes from the lateral face of

the two upper bones of the sternum and from the cartilages of ~~the fifth and sixth~~ all the true ribs except the first ribs, having also a slip coming up from the external oblique muscle of the abdomen. Thus you see it has a very extensive and strong origin, around the chest from which the fibres converge towards the axilla the upper running downwards, the lower upwards, and is inserted into the outer edge of the bicipital groove upon the os humeri between the insertion of the deltoid and the passage for the biceps down the arm. In crossing from the chest to the arm the muscle becomes twisted upon itself in such a manner that the upper part is turned under and inserted upon the opposite or lower side, This gives that rounded cushion like character to the anterior fold of the arm pit which is formed exclusively by this muscle, The action of this muscle will be to draw the arm down towards the side and cross it upon the breast, or if the arm be fixed as in climbing it will raise the body upwards by drawing upon the thorax, In this manner by fixing the arm it becomes one of the forced muscles of inspiration, In the fissure between the deltoid and pectoral muscles is always found the cephalic vein as it ascends to empty into the axillary, and it is in this that Lisfranc proposes to bleed by cutting down upon it, here, when a vein cannot be raised in any other part of the limb or neck. Underneath this we find another smaller muscle called the

or The lower portion is twisted

## Pectoralis Minor,

This is a beautiful triangular shaped muscle and arises from the third fourth and fifth ribs and partly from the intervening intercostal fascia from which it ascends in an oblique direction to be inserted by its narrow portion upon the coracoid process of the scapula, This insertion from being only about half an inch broad is in this subject an inch and a half. so well are all the muscular structures developed Its action when the scapula is fixed, will be to pull up the ribs, or when the chest is fixed to tilt the scapula forward and downward outward, We have then another small muscle the

from part of

## Sub Clavius

Which takes its origin from the first rib near its anterior part, and is inserted into nearly the whole length of the clavicle, the action of this will be to pull the clavicle downwards, and keep it in position. it also acts by covering the vessels with a kind of muscular cushion by which they are protected in a great degree from injury

As I have the large arteries which go to the two sides here exposed at once, I will call your attention for a moment to the variation in their origin. The sub-clavian of the right side comes off from the arteria innominata which is the first branch from the arch of the aorta, - whilst upon the left the artery comes directly from the aorta. Knowing the situation of this great vessel, it must be at once apparent to you that the diff in the situation must be great, for whilst upon the right the artery comes off from the innominata just behind the sterno clavicular articulation and may then be readily reach, being as high up as the top of the curve upon the left, - that coming off from the aorta upon the left makes a short turn almost immediately after leaving the great vessel, and runs across just rising to cross the rib and then dropping at once into the axilla, from this it may be seen that whilst the vessel upon the right may be tied with comparative facility, the same operation upon the left is one of the most serious in all surgery. Whilst upon this subject I may as well just point out the branches that come off from the subclavian between its origin and where it becomes axillary. The first branch is called the Inferior Thyroid Artery or Thyroid Axis, from its sometimes giving origin to two branches, this is distributed to the thyroid gland and oesophagus, this sends off sometimes an anterior, and less frequently a posterior branch called anterior & posterior cervical, - The next branch is the vertebral which runs back to get into the canal in the transverse processes of the vertebra between the sixth and seventh through which it passes up to the brain and becomes the basilar artery there. Notwithstanding its covered position it has been divided on one or two occasions. Two other branches come off in this course of the artery namely the superior scapular, which is often a branch from some other artery and goes to be distributed upon the scapula, - the internal mammary which we shall hereafter see running down upon the inside of the chest to supply the parts surrounding, and lastly the superior intercostal artery which usually branches to supply the two uppermost intercostal spaces, and also sends some small branches to supply the deep seated parts about the neck. A more particular view of these several branches we shall have at another time.

Lect. XXXV

When we remove the skin from the front portion of the chest up to the shoulder and neck, we find beneath, a layer of fascia which is identical with that in the same situation over other parts of the body, it is continuous with the superficial fascia which we have found covering the neck, and shall find over the entire body. It here receives the name of Fascia Thoracis, and covers the entire external face of the pectoral muscle giving a thin coating to the deltoid and is thence continued into the axilla, As it passes across the axilla it is split into several layers between which are lodged a quantity of fatty matter and numerous lymphatic glands, These are not only those belonging properly to the limb, but also from the mammary gland and skin covering the chest. I have seen upon, the vessels of which run as you perceive outwards from the axilla upon the thorax, As the fascia is opened you discover a number of them which are very interesting in a surgical point of view from the affections in which they become implicated, In scrophula these as well as those of the neck and groin are prone to become inflammed and go on the stage of suppuration and abscess, They are also liable to this affection resulting from wounds or ulcerations of the parts from which their vessels come, This inflammation attacking these glands is very liable to involve the loose cellular tissue in which they are placed, and thus give rise to extensive abscess in the axilla Another species of cause also sometimes produces this effect, after various diseases, of a febrile character we are liable to have such abscess formed which is then called "Critical" from the good effect which would seem to result from their formation under such circumstances, These abscesses however originating are liable if neglected to extend down to a considerable distance upon the side of the thorax, from the gravitation of the pus which is constantly secreted, And this burrowing is not always avoided by opening which is always proper in the cases, — unless this be so done as to drain the cavity completely, to effect this purpose the puncture should be made a small distance below the lowest point of the collection, directed a little upward so as to get into the sack at its extreme limit, for if made above, there will constantly remain some pus within which will still tend to gravitate and produce the effect to be avoided, This part which is denominated axilla is much more extensive than would at first appear; extending up to the coracoid process of the

scapula and forming a triangular or wedge shaped space which as we may notice is completely lined by this fascia and fatty matter, in consequence of its attachment to the muscles which form its boundaries. As we sever this Pectoral muscle which forms its sole anterior boundary, and which we yesterday found arising from the inner portion of the Clavicle, the two upper bones of the sternum, the Cartilages of the true ribs except the first ~~fifth and sixth~~ ribs, and also by a slip from the external Oblique muscle, and thence going to be inserted into the os humeri upon the external margin of the bicipital groove, And also sever the Pectoralis minor which from the third fourth and fifth ribs - is inserted into the coracoid process - we have exposed to view from its anterior part, the whole of the axilla or arm pit, Noticing that this latter muscle is only concerned with its upper part, as its oblique direction would indicate, We now see the extensive amount of fatty matter which is contained here under ordinary circumstances, and the number of the before mentioned absorbent glands with which it is interspersed, These vary very much both in number and size, amounting here to about seven or eight. As we proceed to remove this mass, we find it traversed by a great many Nerves and arteries which are of small size. Before proceeding further with the anatomy of the axilla, we may notice the position occupied by the large muscle by which the shoulder is covered this is the

## Deltoid

and is a very extensive muscle, and very important in the functions which it performs, It is quite a large muscle much more so than would at first be supposed from the folded and doubled position which it occupies over the joint, This muscle takes its origin from the outer third, or all that portion which is not occupied by the origin of the pectoralis, - of the Clavicle, from the acromion process, and from the whole spine of the scapula, being in this exactly opposed to the insertion of the Trapezius which we have seen occupying the posterior portion of the neck, superficially, So that in remembering the one we cannot forget the other, appearing like a simple continuation of it with the intervention of the Clavicle acromion and spine of the scapula Thus we see that by studying the muscles in Connexion we may thus be aided in remembering many of the details

which could not be otherwise retained. As we seperate this muscle from its ~~insertn~~ origin and lay it off we find it as before deemed much larger than we had supposed, and spread out over the shoulder in the form of a cap as it were, covering the anterior part entirely, we find upon this part nothing intervening between the muscle and the capsular ligament of the articulation, hence the friction which must take place, has given a necessity for a synovial bursa which you see is of considerable size, and contains the peculiar lubricating fluid, Upon the posterior part we find the joint is covered immediately by the tendons of some muscles which we shall have hereafter to notice which lie between the deltoid and the capsule when the arm is carried backward, but scarcely intervene in the ordinary position of the limb, These muscles are the supra and infra spinatus and the teres minor all of which have their insertion upon the head of the os humeri, As we turn off the upper part these tendons are exposed, and as we extend our dissection we find some arteries of small size going to the muscle for its supply, together with quite a large nervous branch. This is the posterior circumflex nerve and comes off from the axillary plexus surrounding the head of the bone and lying immediately in contact with it untill it reaches the point of entrance into the muscle about its middle, This is the only nervous supply which the muscle receives, and is as you see quite large, Now as we know that muscles have no power of contraction except as they receive the appropriate nervous influence from the centre we must see that in case of accident to such a nerve whereby its function is destroyed, the muscle would be useless. And as this part of the body from its prominence is always exposed to violence we may easily account for the supervention of paralysis of this muscle upon the reception of blows or other force upon the part, Many such cases do occur in which violent compression of this nerve by such a cause has induced a perfect paralytic condition, which may be afterwards be kept up very readily by the subsequent inflammation of the loose cellular tissue by which the nerve is surrounded, Such a condition is to be treated by the most urgent means, such as violent counterirritation to the exterior of the muscle, by which to create a new and stimulating impression upon the ramifications of the nerve, and to detract from the existing inflammation which may be keeping up such a state of the parts. As we have now turned down the muscle

we arrive at its point of insertion which we find to be the outer surface of the bone, and to occupy a considerable portion of that surface, at least two inches in length and of a somewhat triangular shape. This insertion takes place nearly half way down the arm, and hence exerts a powerful leverage upon it. The action of this muscle will be to draw the arm directly upwards, but as it is divided into a great many parts and each acts independently as a separate muscle would, we may have different directions given to the motion which it induces. When the arm is fixed it will tend to support the body or bring it down to the condition of the fixed point, or may tilt the scapula outwards. Upon the removal of this muscle we have a more complete view of the arm pit and are able to appreciate the form and extent of the cavity, We have now also a view of the cephalic vein which we saw between the deltoid and pectoral muscles, in the remainder of its course. It here crosses the axilla and also the subclavian or rather axillary artery in a diagonal direction to empty into the axillary vein which lies below the artery, In the subject before us we have an anomaly in this respect, the vein here going forward and passing under the clavicle to empty itself into the transverse vein just by the side of the sternum. We may notice here again for the sake of perspicuity, the subclavius muscle with its relation to the axillary region, and notice its action in drawing the clavicle inward and approximating it to the first rib, being the only intervention between the region of the neck and that of the axilla; The artery retains the name of subclavian from its point of origin until after having passed over the first rib between the scaleni muscles it gains the space between the first and second ribs, where it becomes axillary, which name is applied to it until it reaches the insertion of the pectoralis, where it becomes brachial and is continued down the arm, The length of the axillary portion as it crosses over, is about three or four inches; The veins which lies upon the outside and below the artery, takes the same name at the same points, These are both surrounded by cellular tissue and at various points by the nerves of the region, the brachial plexus above the clavicle, below only by two trunks from this plexus which lie behind it. for the first part of its

I have seen the cephalic vein running over the clavicle to empty into the subclavian, near the orifice of the external jugular in point of

course, The axillary artery is divided for surgical purposes into three parts which are seen when the pectoralis minor is returned to its original position. This as you may see covers the middle third of the artery, and thus makes the distinction the practical deduction of which we shall soon see. You will observe that the clavicular third lies entirely bare the vein being anterior, the nerves posterior. The middle portion which is covered by the pectoralis minor we see is surrounded by a perfect interlacing network of nerves forming the axillary plexus, and the brachial third again is quite free having only the two roots of the median nerve laying beside or in front of it. It will then appear at once that whilst it would be impossible to tie the vessel in the middle third, that it may be accomplished in either of the others without difficulty both because they are easier to come at, and because the operation would not be embarrassed by the surrounding nerves, being comparatively superficial in either case. We have seen that the pectoral muscle formed the anterior wall of the armpit and we now find the inner wall formed by another large muscle, namely the ~~Ser~~

## Serratus major anticus

the posterior wall being formed by the sub-scapularis and teres major and ~~Lygissimus~~ Lat issimus dorsi, the cavity extending up to the top of the coracoid process of the scapula. This muscle is called serratus because its insertion is serrated or notched like the teeth of a saw, - and major ~~posticus~~ anticus because it is the large anterior serrated muscle. Its origin is by these fleshy tooth like processes from the nine with the exception of the first uppermost ribs, from which extensive commencement its fibres converge and run backwards to be inserted upon the outer edge of the base or posterior margin of the scapula outside of the origin of the subscapularis. Before detaching the parts so as to get a clear view of this large muscle I would call your attention for a few moments to this nerve which comes down from the axilla to be distributed to this muscle. This is the external respiratory nerve of Sir C Bell and is sent here exclusively to supply this muscle, not because it has no other nervous communications, for there are many other branches of the ordinary nervous distribution received by it, but this is sent here exclusively to put it into connexion with the nerves of the chest or muscles of respiration, by this association it becomes one of the prominent forced muscles of inspiration

to be brought into play when necessity requires it. - by this association too it would seem that it is placed in connex-ion with the diaphragm, to act in concert with it, for the external respiratory and the phrenic nerve or that which goes to the diaphragm, come off in conjunction from the upper part of the plexus, whence they separate to their dis-tribution, As I cut through these ~~one~~ and turn off all these parts, we have a clear and complete view of the whole extent of this Seratus magnus, - And we then notice that this is one of the principal muscles by which the upper extremity is connected to the trunk, being the representative of that class of muscles which is met with in quadrupeds, which suspend the body in a sling as it were, Now if we imagine for an instant that man was compelled to go on "all fours" what except this would there be to prevent the body from falling thro-ugh between the extremities, Then if we immagine this to be extended onto the middle line instead of being it inserted into the ribs, and the man going upon all fours you will have a perfect idea of this great sling as it were, which supports the anterior weight of all animals, The action of this muscle will be to slide the scapula forwards upon the thorax or if the scapula and arms are fixed they will move the body back between these fixed points, The diff-erent fibres moving and acting in different portions of the muscle will also diversify the action. We next have to study the proper muscles which belong to the scapula, Consisting upon the dorsum of three which fill up nearly all the face of the bone, and one in the venter or internal surface, The first of these fills all the space above the spine of the scapula as you see, and as I dissect it up you notice that it has its origin from the whole of the fossa above the spine, obliging us to cut the fibres up from the bone This is the Supra Spinalis.
as its origin is from the supra spinata fossa.
From this origin its fibres are directed outwards and somewhat forward, to pass under a progress formed by the junction of the clavicle with the ac-romion scapula, and also under the triangular ligament which is stretched across to prevent the

head of the humerus from being forced upwards out of place. To get a view of the insertions of these muscles it is necessary to cut across these two points and remove them from their position. This accomplished, we see the tendon of the muscle as it passes across the joint, to be inserted upon the of uppermost of the three facets upon the great tuberosity of the os humeri. In attempting to dissect this tendon up from its place, we find that we have cut into the capsule of the joint and have the inner face of the tendon lined by the synovial membrane of the joint, showing us that this tendon forms a part of the capsule. The action of this muscle will be to aid the deltoid in raising the arm upwards, and to rotate it somewhat outwards. This with the deltoid muscle generally offer the greatest resistance and are most difficult to overcome in dislocations of the head of the bone into the axilla they being then of course very much stretched and spasmodically contracting. We are often enabled to accomplish the object by carrying the arm upwards and outwards so as to relax them, when we have failed in every other way. Lower down upon the scapula we find two other muscles, first the

## Infra Spinatis

which arises from the whole spine margin and infra spinous fossa of the scapula, from which it forms a fleshy belly and runs outwards just below the spine and across the joint to be inserted tendinous and fleshy upon the middle facet upon the great tuberosity just below and behind the former muscle. The tendon of this muscle is also implicated with the capsule of the joint in crossing to its insertion. Its action would be to aid in the rotation of the bone outwards, and under some conditions in elevating it. Below this again we have another smaller muscle the

## Teres Minor

This is of a round shape, and arises from a part of the dorsum and costa of the scapula not occupied by the last muscle in apposition with which it lies. From these points it runs upwards and outwards to be inserted upon the third and outer facet of the great tuberosity, being involved in the capsule as it passes over it. With these last mentioned the action of this will be to rotate the arm backwards and throw the palm of the hand outwards and forwards, this muscle will, from its points of origin and insertion tend to keep the arm applied to the side. These are the muscles

which occupy the dorsum of the scapula, we still have a fourth one occupying its inner side or venter. This is the

## Subscapularis

To get a view of this muscle we are obliged to divide the vessels in the axilla so as to turn back the scapula and expose its inner side. This done we notice here a positive termination to the axilla in this direction by coming together of the serratus magnus forming the inner wall and this muscle which forms part of the outer or posterior wall, the two being attached to the base of the scapula. We now have the muscle in full view, and find first that like all others it has its proper fascia investing it. It arises from the whole extent of the base or posterior costa of the scapula just within the insertion of the serratus magnus, and also from the whole inner surface or venter of the bone forming a kind of fleshy cushion by which it is placed against the back part of the chest. The fibres from this extensive origin run outwards towards the neck of the os humeri, and are inserted by a flat tendon into the upper part of the lesser or internal tuberosity of that bone. In as much as I have mentioned to you before, that we do not judge of the strength of a muscle by the length of its fibres, but by the number of them we may at once see that this is a very powerful muscle, — the length of fibre only denoting the quantity of contraction of which a muscle is capable, whilst the number of fibres are always indicative of power. This muscle will act by rotating the arm inwards and drawing it towards the side of the trunk, being one of the muscles by which the trunk is raised when the arms are made the fixed points of contraction as in climbing. We notice now that the muscles connected with the base or posterior edge of the scapula are the rhomboidei, the serratus magnus, the three muscles upon the dorsum of the bone, and the subscapularis which also arises from the whole venter even as far forward as the neck of the bone, — these forming the whole of the scapular muscles, except those as the levator anguli, and trapezius which have attachments to it. By this you see that this bone has no fixed or immediate connexion with the trunk whatever.

**Lect. XXXVI.**

I have gentlemen already exhibited to you and described the muscles of the scapula and shoulder with the exception of a single one which we shall have seen to notice, - in connexion with the trunk and the muscles by which the shoulder blade is attached to the trunk. It may not however, be out of place again to go over these muscles of the scapula and articulation again to day, in connexion with the upper extremity which we have here separated, when the many different views of them can be had better, by turning this extremity in the various different aspects. We may first glance then at those which separate the scapula from the thorax, and first of these the serratus magnus, which we find coming from the nine superior ribs to be inserted into the scapula. This has of course been divided in the separation of the extremity. I would call your attention particularly to a quantity of loose and very movable cellular tissue lying upon the inside of this muscle between it and the trunk. The necessity for the existence of such a substance here is very apparent when we take into view the great deal of motion of which the scapula is capable in order to extend the usefulness of the upper extremity. This layer of substance then at the same time that it connects the parts allows them to move freely upon each other being so loose as to permit me to raise it in the forceps without however detaching it. In connexion with this, we sometimes have either spontaneously or resulting from accident, - inflammation developed, which proceeding to suppuration, pus is deposited in a situation which as you see must be very confined. The result of this is an accumulation which from gravity burrows under the muscle and fascia until it reaches the lumbar region when a tumour is developed if the case be left to take its course. A case of this kind wherein an abscess had formed occurred in a gentleman of the class some time since, in which I made a puncture, as should always be done, - and discharged the matter, after which rest was all that was necessary to effect a cure of the case. The opening should, as in every case of abscess, be made at the most depending part, and in such a case with great care. Between this and the subscapularis muscle which lies next to it you observe there is some space, which is the posterior portion of the arm pit, these two muscles as before mentioned forming a part of the boundary of this space. This latter muscle has no connexion with the trunk what-

-ever, arising from the whole of the base of the scapula and going to be inserted upon the lesser or anterior tuberosity of the os humerus. As it crosses the arm pit this muscle or rather its tendon is involved in the capsular ligament of the articulation appearing to pierce the capsule, and being lined upon its inner face by the synovial membrane of the joint, supplying in fact the place of a portion of the capsule to this part of the joint. In dislocations of the head of the humerus into the axilla, of course the bone will descend upon the tendon of this muscle which will be put very much upon the stretch and is often indeed broken off or torn by the force applied, allowing the bone to escape entirely down into the arm pit, when by its pressure upon the nerves and cellular tissue which we have found there, a great degree of inflammation may be thus induced. We next take a second view of the muscles upon the back of the scapula which we yesterday noticed. The first of these the supra spinatus we found originating from the whole of the fossa above the spine of the scapula, whence it proceeded forwards beneath the triangular ligament and acromion to be inserted upon the head of the humerus forming as it crossed the joint, a part of the capsule. The second is the infra ~~scapular~~ spinatus, which arises from the fossa infra spinatus and after passing forwards and outwards is also inserted into the head of the bone and forms also a part of the capsule. The third is the teres minor and is smaller than either of the others, arising from the lower portion of the scapula adjoining the last, to be inserted upon the head of the bone externally to the last named muscles. These four muscles are those proper to this joint and give to it by their tendons the necessary support by keeping the head of the humerus drawn up in contact with the glenoid cavity of the scapula, for all of these tendons run within the joint and form a part of the proper capsule, which is as it were attached to muscles thereby. We are made acquainted with the use and importance of these muscles to the integrity of the joint, in cases when they become paralysed, under which circumstance the bone drops loose in the large capsule which is necessary to accommodate its

various motions, and the least disturbing force produces a dislocation of the head of the bone. The Deltoid which covers in the entire shoulder with the tendons of these muscles will also aid in this function of keeping the joint in close apposition. There is another muscle connecting the two bones or rather passing from one to the other, in the neighbourhood of this joint which we have not as yet noticed. This is the

## Teres major

a round shaped muscle of considerable size, having its origin from a small rough surface upon the inferior angle of the scapula, and also from a part of the anterior margin where it is thicker than in any other place, - in conjunction or apposition with the teres minor from which it is only separated by an artery which get upon the surface of the muscles through the fissure between them, namely the inferior dorsalis scapula. From this origin the muscle forms a regular fleshy belly and ascends forwards and outward dipping under one of the heads of the triceps, to be inserted upon the posterior margin of the bicipital groove upon the os humeri. The tendon of the Latissimus dorsi is also inserted upon the inner or posterior margin of this groove and these two form the posterior fold of this cavity, the teres major however being inserted lower down upon the groove forms the inferior part of the fold. The action of this muscle is to draw downwards and backwards the arm, and also to rotate it somewhat inwards, in this antagonising the other muscles upon the dorsum of the scapula, varying its action of course as the arm becomes the fixed point acting then by rocking the lower angle of the scapula which is very movable, outwards. We here see that the posterior and anterior folds of the axilla are made by these different muscles which we have left attached, the first by the pectoralis major, and the second by the latissimus dorsi and teres major, both sets being inserted upon the same level. Between the insertions of these two ~~muscles~~ sets of muscles we have passing down the front of the arm the axillary or brachial artery and vein, the great nerves from the axillary plexus, with the biceps, and coraco brachialis muscles, the artery vein and nerves lying upon the inner margin of the biceps and partly overlapped by it. We must now turn out attention to the extensor muscle of the arm seated here namely the

## Coraco Brachialis

This muscle in connexion with the short head of the Biceps

arises tendinous and fleshy from the Coracoid process of the scapula, as its name imports, - being so commingled with the head of the biceps that it is impossible here to make any dist-inction, This union however does not continue for a great distance down the arm before a division becomes apparent and the Coraco brachialis then goes to be inserted into the Os humeri near its middle, This insertion is fleshy and is upon the inner side of the bone. The action of this muscle will be when the arm is fixed to tilt the scapula forward, or when the scapula is fixed to carry the arm upwards and forwards, which is its usual office. The next muscle to which I will ask your attention is the

## Biceps Flexor cubiti.

So called from being a double headed flexor of the cubit or forearm, in this different from the muscle last considered which was a flexor of the arm. The short head of this muscle we have seen coming principally fleshy from the Coracoid process of the scapula in common with the Coraco brachialis, The long head we find coming in the form of a small but strong tendon through the bicipetal groove, in which you see it is bound down by ligamentous fibres which cross above it from one side to the other, It is here accompanied by an arterial branch which we shall have to notice hereafter, When we dissect up this ligamentous covering and trace the tendon on upwards we find it passing within the capsule of the joint over which it crosses to be inserted upon the scapula, just at the upper edge of the glenoid or cup like cavity for the head of the bone, This tendon does not pass loosely through the cavity of the joint for in such a case the fluid could not be confined in the joint for its lubrication, - but is covered by the synovial membrane while within the capsule, and on leaving it has a reflection of this membrane thrown out around it like the finger of a glove, for some distance below the joint and below the head of the bone, From this we may see that an incision through the soft parts at this point, would open this reflection of membrane and as it is continuous with the cavity of the joint would be equivalent to opening this, - admitting the synovia to flow out, and all the evil consequences generally resulting from an injury of this membrane in accidents about the joints, The two heads of this muscle are of so near the same length that some anatomists

in distinguishing them in their descriptions, have applied the epithet longus to the one, whilst others have associated it with the other. In the subject before us we find an anomaly with regard to this muscle, which although not often is yet sometimes met with, namely, a third short head coming from the os humeri near the insertion of the Coraco Brachialis and joining the belly of the muscle some distance below this point. This of course serves to strengthen the muscle and somewhat increase its size, It is here however no longer biceps for the occurrence of this third head will render it triceps or three headed flexor of the forearm. By the union of these heads whether there be two or three, we have a fine large rounded belly formed which proceeds down the arm upon its anterior internal face, until arriving near the elbow-joint it becomes tendinous and crosses the joint about the middle to be inserted principally into the back portion of the tubercle of the radius Immediately on crossing the elbow joint the tendon of this muscle sends of an aponeurotic expansion, which spreads out and becomes identical with the fascia covering the fore arm, Thus it has a double or divided insertion, The principal action of this muscle in contracting will be to flex the fore arm upon the arm, for which from its peculiarities of origin and insertion it is peculiarly adapted, It has however other offices, thus from the position which you see the tubercle of the radius has when the hand is turned supine, being then just between the two bones, it must be evident that when the radius is rotated by turning the hand prone, this tubercle must be carried back wards onto the outer back part of the arm, Well the tendon being inserted upon the back part of this tubercle must in this rotation be wound around the bone in which condition it rests when the hand is prone, When the muscle begins to contract in this condition its first action will be as you see to unwind or straighten its self, and in doing this will supinate the hand, Thus to its function of flexing the fore arm we may add that of supinating the hands The use of the aponeurotic tendon which it sends off, appears to be to protect and bind down the parts of the fore arm and particularly to preserve the brachial artery from injury or displacement as it runs immediately beneath this part of the tendon being here somewhat superficial and liable to accidents from without, under this aponeurosis, between it and the vessel we have some cellular tissue and a little fatty

matter, and over it we have the common superficial fascia in which run the superficial veins in which we bleed, In this operation either chance, choice or necessity may induce us to puncture a vein which runs over this aponeurosis, and in doing this the lancet may transfix the vein, pierce the cellular tissue below and pass through this aponeurosis, into the cellular tissue beneath with or without wounding the artery, If the vessel is not wounded, two sets of symptoms are liable to be induced, the one of which however is not equally serious with the other, We may first, then, have an infiltration of blood into this cellular tissue through the puncture, forming a tumour which so distends the tendinous expansion, as to prevent the patient from bending his arm, and making him suffer great pain in consequence of this distension, This collection of coagula is however generally absorbed without the necessity of any very active interference on the part of the surgeon, In the other more serious consequence of such puncture, the cellular tissue inflames and goes on to suppuration often in spite of all that can be done, and this occurring in such a confined condition cannot fail to develope great pain and con-constitutional disturbance, The suppuration going on and no exit for the pus we have a tumour formed as in the other case, which if not cut down upon and freely opened will in all probability involve the joint in a disease which will cost the patient his joint or life in the end, The proper mode of opening such a collection is of some importance for here you have not only the artery in an exposed situation, but the veins and particularly the nerves, a division of any of which would result in a paralysis of a part of the arm corresponding to it, The incision through the skin and fascia should therefore be carefully made in a longitudinal direction, and the aponeurosis raised upon a director and divided freely to give vent to the pus. - the wound being afterw fomented and healed from the bottom, and the joint if anchylosed in consequence of a continuance of one position, must be treated accordingly by extension and passive motion with frictions &c. We have seen now the Coraco brachialis an extensor of the arm, and also the Biceps is flexor of the fore arm upon the arm, we next come to the second extensor of the

forearm, and this is called the

## Brachialis Internus

or anticus so called in contradistinction to the third head of the triceps which has sometimes been called Brachialis externus or posticus, This muscle arises by a forked fleshy origin from the anterior portion of the humerus near its middle, one origin being upon each side of the insertion of the Deltoid, In consequence of this divided origin this muscle has been called and described by some anato-mists fond of new names, musculus bicornis, or double horned. This is quite a large muscle, covering by its origin the whole anterior inferior portion of the humerus from whence it becomes narrowed in approaching the elbow joint when it terminates in a rounded tendon which is inserted into the coronoid process of the ulna just in front of the joint The action of this muscle will be felt wholly and only upon the forearm which it will tend to flex upon the arm, the disadvantage in the leverage of its insertion being compensated by the number of its fibres, Thus you see we have two proper flexor muscles of the forearm; one inserted upon each of its bones, by which to equalize the action of flexion, We have now to revert the extremity and take a view of those upon the back of the arm which antagon-ize those just noticed; here we have but a single musc-le to occupy us namely the

## Triceps Extensor Cubiti

or three headed extending muscle of the Cubit or fore arm These three heads are generally called the long middle and short, or the first second and third heads, but would be better described as has sometimes been done as the internal middle and external heads, The longus or middle head arises from the inferior costa of the scapula near the neck or glenoid Cavity and crosses onto the arm between the teres major and minor muscles, the second or external head arises ~~fleshy~~ a tendinous and fleshy begining from the neck of the os humeri upon its outer and posterior face just below the insertion of the teres minor muscle and joins the others about the middle of the arm, The inter-nal or short head sometimes called brachialis externus in distinction to the internus or anticus which we have seen arises from the inner back part of the humerus about the junction of the upper with the second fourths of its length

and joins the other two to make a large fleshy mass wh-ich towards the olecranon process becomes spread out into a thin tendon by which it is inserted into this process, an aponeu-rotic expansion being continued from it down the fore arm, to be continuous with the general aponeurosis. The action of this muscle is that of extending the fore arm upon the arm, and the aponeurotic expansion from it will make its action felt even in cases when the Olecranon has been fractured, We have next to look at the main trunk of the artery as it passes down the arm and notice the branches which it gives off, We see that the direction after emerging from the fossa beneath the clavicle it passes straight down the arm upon the inner edge of the biceps muscle, and the first branch which it gives off in the course is the subscapular which I here show you in the arm pit we may remember having seen one which comes off from the subclavian above the clavicle called the superior scap-ular from which this must be distinguished, This subscap-ular branch is sent principally to the sub-scapular mus-cle, but before entering this it gives of a branch which winding round the inferior costa gets upon the dorsum of the bone between the teres major and minor muscles to which it is principally distributed, sending however a small branch in contact with the bone, to the infra spin-atus muscle, this is the Dorsalis scapula inferior before noticed, Below this we have given off the anterior and posterior Circumflex arteries, the anterior of which winds round the bone under the coraco brachialis and ascends the bicipital groove to supply the capsule and synovial membrane which in joints where much motion exists must make copious secretions and therefore be copiously supplied by arterial blood, The posterior Circumflex artery is much the largest of the two winds round the head of the bone posteriorly under the teres major and lattissimus dorsi muscles and is distributed principally to the Delt-oid muscle with the circumflex nerve which we have before noticed in connexion with the muscle This artery also gives off a branch to the capsular ligament and synovial membrane, and now you may see what an abundant supply of arterial blood is sent to this joint for its use. Some other of the branches of the Brachial artery will occupy us when we meet again,

Lect. XXXVII.

I propose to day gentlemen to draw your attention to the anatomy of the fore arm, which is of much importance to become acquainted with, Upon it we have situated a great number of muscles say 18. immediately belonging to the fore arm and exclusive of the muscles, of the hand Of these 18 muscles eight come from the internal condyle of the humerus (except one) and are all concerned in the flexion and pronation of the hand and fingers, From the mass situated around and upon the external condyle of the humerus there proceeds ten muscles which are principally concerned in the extension and supination of the hand and fingers, antagonising those first mentioned, and making up the whole number eighteen. Over the fore arm as well as over the arm we have a dense strong fascia extended, from which processes are sent down between all the muscles, called the intermuscular ligaments of the fore arm, from the fact that a great many of the muscular fibres get their origin from these processes, From the great number of muscles, and the comparative small surface of bone to which they may be attached, the necessity of such an extension of origin must at ~~once~~ appear necessary, and hence the importance of the strong processes sent for that purpose. The aponeurotic fascia covering the fore arm, from which these processes come is quite distinct from the ordinary superficial fascia which here as elsewhere is found covering the parts beneath having an entirely different office, the latter being intended only to connect the skin with the parts beneath and give them motion upon each other, whilst this binds the muscles in their places, and extends their origin, As this proper fascia extends down over the wrist it becomes thickened by the addition of a great many fibres, and forms the anterior annular ligament of the wrist joint, This you will perceive to be a very dense strong ligamentous continuation, attached upon one side to the os pisiforme and the unciform process of the os unciforme, and upon the other to the scaphoides and trapezium, by which the numerous tendons of muscles passing to the hand and fingers are bound down and kept in their respective places, In inflammation of the bursal sheaths which line the internal face of this anterior ligament, which sometimes occurs from sprains or other accidents, the synovial membrane is stimulated to increased secretion, and a dropsy of the bursa is the consequence. This does not swell and bulge the ligament outwards on account of its great

strength, but produces a tumour above and below it, of an hour-glass form, the fluid in which may be pushed from one tumour to the other. In these collections are generally, or often developed small white bodies like grains of rice or small beans, amounting in some cases which have come under my notice to one hundred. Extending from the lower edge of this anterior Annular ligament we have a thick dense aponeurotic process, called the fascia palmaris, which after growing wider as it proceeds downwards, is divided into four processes, one for each finger each of which in its turn has also two horn like extremities by which it is inserted upon each side of the metacarpo phalangial joint, making a strong and resisting covering to the whole palm. Now we know that this part of the hand is subject to much use, and that through it runs some sensitive nerves and also arteries and veins, and hence the necessity of this palmar fascia to protect these from injury; This fascia when injured by pressure or otherwise, contracts violently as in Club foot causing a fixed flexion of the fingers, for the relief of which Dupuytren has devised a very ingenious operation, but in a great majority of the cases of contraction which have come under my notice the tendons themselves have been in fault. We now come to the consideration of the muscles of the fore arm but first I will call your attention to a triangular space left between the edges of the two sets of muscles coming from the opposite condyles, at the upper part of the fore arm, the base of which triangle is at the bend of the arm. In this run down the brachial artery with its two accompanying veins, and the great median nerve. We have here moreover coming out from the venae comites, a large branch to form an anastomotic connexion between the deep seated veins and those superficial ones in which we bleed. This large branch goes to throw itself into the median cephalic or median basilic, and thus accounts for our being able to obtain blood more freely from these than from the main trunks themselves although they be of the same size, and also shows why the increased flow comes from upon moving the fingers so as to contract the muscles, and force the blood out from

them through this vein. The first of the muscles of the forearm which we shall notice is the rounded one which forms the inner boundary to the triangle of which we have just spoken and is called the

## Pronator Radii Teres.

This muscle arises from the internal condyle of the humerus, and from the intermuscular ligaments, having at times also an origin from the coronoid process of the ulna. In examining the origin of this muscle you perceive that I am compelled to divide the fibres from these intermuscular septa making an artificial opening. After having isolated it and cut across the part coming from the internal condyle, we find a second head as it were originating from the coronoid process of the ulna upon which you will remember the brachialis internus was inserted. This head is much smaller than the first, and between the two runs as you see the median nerve in its course down the arm. When we raise the second origin and detach the muscle throughout its length, we find it inserted upon the outer face of the radius near its middle. When we say outer part with regard to the upper extremities it is necessary that you should bear in mind the position in which the limb is supposed to be placed, for in all anatomical descriptions of these parts the hand is supposed to be placed supine, or with the back downwards. The action of this muscle will be upon the radius, to bring it over the ulna and thus rotate it, bringing the palm of the hand prone, or downwards, as the name imports. The next muscle which we have to notice is a small one situated usually next upon the inner side of the one just mentioned and called the

## Palmaris Longus

This generally arises from the internal condyle of the os humeri, and forming a short fleshy belly terminates in a long thin tendon, which is inserted into the under and lower surface of the anterior annular ligament and into the upper part of the palmar fascia. In the present instance we have an anomaly with regard to this muscle, which arises from the ulna nearly half way down the forearm, from which it forms a long thin muscle which becoming tendinous near the wrist is inserted as before mentioned. The action of this muscle will be to raise and make tense the palmar fascia and thus aid in giving protection to the parts below. as it prevents pressure. The next muscle in succession is

the

## Flexor Carpi Radialis

which arises from the internal condyle and two faces of intermuscular ligament, from whence it grows fleshy and terminates by a long tendon which passes over the outer side of the wrist joint through a groove in the trapezium to be inserted into the metacarpal bone of the fore finger. The action of this muscle will be to flex the radial side of the hand upon the arm. Before raising this muscle I would call your attention for a moment to its position in relation with the radial artery in which we generally examine the pulse. This artery as you see lies immediately upon the outer side of this tendon, between it and the tendon of the supinator radii longus muscle, thus by cutting down at the edge of the former tendon we may at any time come upon the vessel and tie it. As we raise it up from its position we have next brought into view its associate muscle of the opposite side of the arm, namely the

## Flexor Carpi Ulnaris

which has a very extensive origin, and is quite a large muscle. It arises first by a forked extremity from the internal condyle of the humerus and from the side of the olecranon process of the ulna, between which two origins proceeds the ulnar nerve as it winds around the condyle to get to the forearm. In consequence of this pec-uliar position the nerve is here very superficial and of course exposed to violence. Burns about this part although quite light and superficial in character from involving this nerve, warrant an amputation, as the risk of tetanus and the patients life is so great. One case I have seen in which such a burn, in an individual of considerable imp-ortance resulted in tetanus and death. This position and the liability to injury is important to be recollected as such cases are of not unfrequent occurrence. The nerve is larger at this point than it is above, and this circums-tance in other cases, is not sufficiently dwelt upon by anatomists. This nerve contains a part of the great sympathetic system ~~which~~ always produce a gangliform swelling about the joints as they are distributed, and which may be consider to be true ganglions. This F. Carpi Ulnaris has its origin also extending three fourths of the way down the inner margin of the ulna, and sometimes in very muscular subjects may even extend almost to the wrist joint. It is inserted upon -

the os pisiforme, and in some instances is extended down to the metacarpal bone of the little finger, The action of this mus-cle will be to flex the hand upon the wrist at the ulnar side or acting in conjunction with the F.C. Radialis, produce a perfect direct flexion; By its attachment to the little finger it will also act as an abductor of it. Upon the inner face of this muscle lies the second large artery of the fore arm, which however is not so large or so superficial as the Radial. This is the ulnar artery which passes in front of the annular ligament to the hand being bound down as it crosses the ligament, by a process of fas-cia from the os pisiforme to be connected with the annular liga-ment. The next muscle to which I shall call your attention is one which lies in close proximity to the last two, namely, the

## Flexor Digitorum Sublimus Perforatus

So named from its function and position with regard to another deeper seated one which we shall ~~not~~ice before long. This muscle arises from the internal condyle, from the coronoid process of the ulna, and by a fleshy slip from the inner face of the Radius just below its tubercle, having passing between its two heads the median nerve and ulnar artery, the ulnar nerve not accompanying the artery here, or indeed in any part of its course except the middle of the fore arm where they run together for a short distance, As these points of origin are successively raise you may see them distinctly, all going to form a large strong muscle which divides above the annular liga-ment into four tendons, one for each of the fingers, These tendons may be separated entirely up into the belly of the muscle form-ing as it were as many distinct muscles, each of which having a particular origin may contract independently of the others and thus enable us to flex one finger without flexing all the rest to which the muscle as a whole is distributed, These tendons pass under the anterior ligament where they are inclo-sed by synovial membrane which forms a sheath around them in which they play, As I cut up the annular ligament we have brought into view the bursa of which I spoke as forming the hour glass shaped tumour, and also the sheaths by which each of these tendons is surrounded, and which offer considerable resistance as I attempt to tear them up Anterior to these tendons we see the median nerve passing to its distribution, after drawing this aside the tendons are fully exposed, with them their bursal sheaths around them, through one of which you see the pipe is passed

showing it to be much larger than the tendon which it accomodates, we find each of these tendons here passing under the superficial palmar arch as the artery is here called, - which has been left in order to exhibit its proximity to the surface - The tendons thus get one to each finger, at the base of the first phalanx of each of which they enter a kind of tube called the vaginal sheath, which is formed by a strong layer of ligamentous fibres passing across from the junction of the posterior rounded surface of the bone with the anterior flat surface, on one side to the same point on the other. These vaginal ligaments extend the whole length of the fingers and bind the tendons in their places, being lined throughout by a proper synovial membrane, in consequence of which a wound or fellon upon any part is exceedingly liable by an extension of the inflammation to involve the whole sheath, and often ascend up the tendon to other parts. These sheaths one of which I now open, you perceive run down and terminate at the base of the last phalanx, where the ~~last~~ of the deep flexor tendon is inserted after which of course they would not be of any use, We now have exposed to view not only the tendon of this muscle but also of the deep seated flexor of the fingers, and we find that that of the flexor sublimis splits to allow of the passage of the other through it, and is inserted by its two horns into each side of the second bone of the finger near its base, being like the other tendon fastened by membranous processes, more or less to the bones throughout its course. The action of this muscle will be to bend the second phalanx of the fingers without the first, and if the contraction be still further continued, to bend the hand upon the wrist. In this action if it was not for the strong anterior annular ligament by which these tendons are bound down at the wrist, we should have them starting out and forming very unsightly as well as inconvenient swellings, We next have to notice the other muscle of the fingers, namely, the

## Flexor Digitorum Profundus Perforans

This lies immediately below the last muscle considered and between the two are found running the Ulnar artery and Median nerve in their progress down the arm, And in the middle third of the arm the Ulnar nerve also accompanies these upon the ~~outside~~ of inside of them,

This muscle like the last has a very extensive origin, coming first from the condyle (internal) under the origin of the flexor carpi ulnaris, and from the upper two thirds of the inteross-eous ligament, and also from a considerable part of the upp-er portion of the Ulna, There is also occasionally in very muscular subjects, a portion coming from the radius to join the muscle. It soon becomes tendinous upon its outer face and as it approaches the annular ligament divides into four ten-dons which are however all confined in one large bursal sheath of synovial membrane. This is a very important part of the demonstration of this muscle. for it is of much consequence to know the manner in which these sheaths are arranged aro-und the different tendons, in cases when they are affected by acute inflammation or those more chronic affections which produce dropsies &c. These tendons like those of the muscle last studied may be separated and traced up so as to form as many distinct muscles, by which the action of each set of fibres is rendered independent of the others, These tendons pass beneath the annular ligament under those ~~of~~ the flexor sublimus and are then like it distributed to the appropriate fingers. where they are inserted into the base of the last phalanx, It should be particularly observed that the tendon of the sublimis splits for the passage of these deep seated ones about half an inch ~~below~~ above the base of the second phalanx, for in cuttings of these tendons if cut below this point both will of course be divided and the tendons retracted in the vaginal sheaths so that the finger will ever after remain fixed in an extended position This should be particularly recollected in injuries about these parts as mistakes are often a consequence of inattention to these minor points of practical importance. The action of this muscle will be to bend the first phalanx upon the second, ~~after~~ wh-ich it will act as a flexor of the hand upon the forearm, As this muscle bends the third upon the second, and the flexor sublimis bends the second upon the first, so to complete the set, although the extended action of these two will have the effect of bending the metacarpo phalangial joint, – we have other small muscles engaged in this action which act indep-endently of the great flexors. These are called the

## Lumbricales.

They are situated in the palm, are about three inches long, and resemble some what, earth worms, from which they derive their name, there is one of these appropriated to each finger, arising

from the external side of each of the deepseated flexor tendons by a tendinous begining, which growing fleshy into small round bellies are inserted into the outer margin of the base of the first phalanx, These were formerly called fiddlers muscles, as they were supposed to belong to those motions of the fingers which were exercised in playing upon the violin. These cannot from their size exert much force in contracting but seem rather to be intended to produce rapid and light motion, They are supposed to be the muscles concerned in the quick motions necessary to play upon the piano, There is another flexor muscle which we have not as yet considered, this is called the ~~flexor~~

## Flexor Proprius Pollicis

This muscle arises by a fleshy slip from the internal condyle of the humerus, which after extending some distance down the arm is merged in the in the larger portion of the muscle which comes from the radius commencing immediately below its tubercle and extended down for some distance on the front surface of that bone, from this origin a fleshy belly is found which becomes tendinous before reaching the wrist, where it passes under the annular ligament and goes to be inserted upon the last joint of the thumb, the action of course being to bend this phalanx in opposition to the fingers, This is the muscle which is peculiar to man and renders the hand a perfect prehensile instrument, Neither monkeys nor any other animals are furnished with this muscle and the distinctive mark of difference in the limbs is therefore easily seen, The next muscle to which our attention must be given, and the last of those upon this side of the fore arm is not a flexor like the last but from its action is called

## Pronator Quadratus

This arises from a space of about two inches in length upon the ulna at its lower and inner part, from which the fibres run almost transversely to be inserted upon the anterior part of the radius nearly opposite its origin, thus forming as its name imports a quadrilateral ~~shaped~~ muscle whose office it is to turn the radius together with the hand over upon the ulna and render it prone, This muscle should be well studied and remembered as its action has frequently to be overcome in accidents, as fractures of one or both bones of the fore arm, when it is generally spasmodically contracted.

Lect. XXXVIII. I propose to day gentlemen to call your attention to the extensors and supinator muscles of the fore arm, which form the fleshy mass about the external condyle of the humerus. Of these there are ten in all, generally having their origin from the condyle and the ridge upon the bone leading upwards from this condyle. The first one to which I shall refer is called the

## Supinator Radii Longus

This is the most external of those constituting the mass, and has its origin upon the ridge of the humerus which leads to the external condyle. This fleshy origin fills up a groove which would otherwise exist between the triceps posteriorly and the Brachialis internus, anteriorly. Between these muscles run down the profunda magna or spiral artery and the musculo spiral nerve. It is important to remember the line of demarcation between this supinator and the Brachialis internus for in it dips down a process of fascia, by following which we are enabled to reach the bone without much muscular derangement, in order to use our gouges chisels &c for the removal of necrosed portions of bone. In such cases it is very necessary to remember that the vessels and nerve before mentioned also occupy this space, in order to avoid wounding them in the operation, for if by chance in separating the muscles the nerve should be cut, it would entirely paralyze the extensor muscles of the thumb and other parts. From its origin the muscle grows some what flat and getting upon the radial side of the fore arm, terminates in a long tendon about mid way of the arm, and goes to be inserted upon the radius near the styloid process of that bone. In its progress towards the base of the styloid process it forms the external boundary of that triangular space below the bend of the arm through which the brachial artery and median nerve run. The action of this muscle will be, when the hand is turned prone or with the face downwards, to rotate the radius, and turn it over upon its back, as in the former position the muscle is partially wound around this bone. After the act of supination has been accomplished, it will tend from its origin above the elbow joint, to flex the fore arm upon the arm. Its action however as a flexor is very slight and can only take place under certain circumstances of supination and strong contraction, its chief office being that of turning the hand supine. The next muscle, or

rather two muscles, for they may very well be associated together in description are the

## Extensor Carpi Radialis Longior and Brevior,

The longer arises from the ridge above the condyle, from the intermuscular fascia, down to the condyle, being immediately below the Supinator radii, The shorter comes from the external condyle below the last, and the two together are continued down the outer side of the arm through a groove upon the outer side of the styloid process of the radius, the first or longer to be inserted into the base of the metacarpal bone which sustains the fore-, and the shorter into that of the middle finger, the tendons passing under those which go to the thumb, The action of these muscles will be to extend the hand at the wrist joint by first bending the first carpal row and then the second. This action accomplished it may aid also in the extension of the fore arm, and when the hand is strongly prone may cause supination to a considerable extent, as the tendons, in this position must be wound out of the ordinary straight line of action, We may now look at the contrivance by which these muscular tendons are kept in their places, and as we saw upon the front of the wrist joint an anterior annular ligament extending from the os pisiforme and unciforme across to the trapezium and scaphoides, so have we here a posterior annular ligament, running from the styloid process of the radius to the styloid process of the ulna, being also attached in a membranous form to many of the bony points around the wrist, This ligament is not so dense and strong as the anterior one, as the tendons here have not the same tendency to start out of their places by the contractions of the muscles, which here act over a curved surface principally, instead of, as in the other case, acting in the direction of ~~an arc~~ chord to the ~~curve~~ arc.
The next muscle to be noticed is the

## Extensor Carpi Ulnaris,

which arises partly from the external condyle of the humerus, the fascia and intermuscular ligaments but also from the side of the ulna for some distance down the margin of that bone, after which it terminates in a tendon which passes through a groove at the lower end of the ulna, inside the styloid process, to

be inserted into the back part of the metacarpal bone of the little finger, This tendon as it passes down to its insertion is enclosed in a perfect sheath of synovial mem-brane as it passes under the ligament, The action of this mus-cle as its name imports, is to extend the carpal joints with the two upon the opposite side, In connexion with this external condyle we have to notice a small muscle which does not properly belong to the set we are considering, or to any other. it is situated at the upper part of the arm and called the

## Anconeus

This muscle arises from the back part of the external cond-yle where the triceps passes down, with which it crosses the joint being attached to the capsule, From this origin it passes obliquely across to be inserted upon a ridge extend-ing some way down upon the bone, of which it covers a considerable part, This muscle looks very much like a part of the triceps extensor, and might very well be des-cribed as such, as its function, to aid in extending the arm is precisely the same with that of the muscle nam-ed, we next come to the consideration of the

## Extensor Communis Digitorum.

This muscle has a somewhat extensive origin, fleshy and tendinous from the external condyle, where it is connected with some of the other muscles of the part, As it approaches the wrist it becomes tendinous dividing into four one of wh-ich is more distinctly separated, and smaller; they may however all be split up into separate muscle by pulling them asunder, The three larger tendons go to the three larger fingers, whilst the smaller is appropriated to the little finger, From the distinctness of this little slip from the rest on many occasions, it has been dignified by a separate name as a distinct muscle, being described by some, as the auricularis muscle as it enables us to extend the little finger alone in the manner of introducing it into the ear, Whilst the three larger tendons pass through the annular ligam-ent in a common groove, this small one has a separate passage, in its way to the little finger, As the origins are inseparable, the insertion in the same manner, and the action the same, there is no reason why a division should be made in the description, As we trace the tendons in their course downwards we find them becoming thickened and widened at the metacarpo-phalangeal joints, in order to cover in

and perform the part of a capsule to the posterior part of this joint. A portion of the tendon is here separated upon each side and inserted into the first phalanx, the part of the tendon which proceeds forward is again divided near the next joint and a portion inserted upon the second phalanx, whilst the remaining portion is still continued forward to be attached to the back part of the third and last phalanx giving each of the joints a capsular covering in part of their extent, as the tendon passes to the separate insertions. Hence the action of this muscle must be to extend all the joints of the fingers one upon another, and after this is completed, to extend the hand upon the arm at the wrist joint. We notice with regard to these tendons, that as they pass over the back of the metacarpal bones of the hand they send of slips which pass from one ~~tendon~~ tendon to the other. This communication between them shows us the reason why under ordinary circumstances all the fingers are extended together, or why one finger cannot be extended without acting upon the others to a degree, except it be in those cases where these movements have been acquired by practice. This connexion excludes the little finger which we have seen has a somewhat distinct provision for its use. As we have seen this arrangement to facilitate the motions of the little finger, so we shall now find a still more perfect one for the fore finger, which has a separate and distinct muscle appropriated to its extension. This however is small and is called the

## Indicator

This muscle gets its origin from the posterior part of the Ulna below its middle, and also from the interosseous ligament between the bones at this point, from whence it passes obliquely down and is inserted into the fore finger in common with the tendon from the last named muscle, passing under the same groove in the ~~annular~~ annular ligament. By the existence of this little muscle we can explain the facility with which we can extend the fore or index finger independently of the remaining ones, and hence it has received the appellation of the indicator. When we cut up the extensor communis digitorum after having studied all these parts, we bring into view a smaller muscle situated upon the upper part of the fore arm called the

## Supinator Radii Brevis

This muscle is deeply placed being covered not only by the last mentioned muscle but also by the supinator radii long-us and the carpal extensors upon the radial side, after having seen clearly the relations which these external muscles bear to this, which is always a point of importance, to be studied whilst the parts retain their natural positions, we will now cut these outer muscles up from their origin in order to get a full view of this which is an important muscle in the movements of the arm, being much more effective than the long supinator although comparatively small, for as I have often told you, we must judge of the power of a muscle rather by the number, than the length of the fibres, and also by the favourable or otherwise condition of its origin and insertion. This short supinator arises from the external condyle of the humerus, from the external lateral ligament, and also from the annular ligament surrounding the head of the radius, From this extensive origin it is extended obliquely across to be inserted upon a ridge on the radius anteriorly or internally, Thus we see that in strong pronation this muscle is wound completely round the bone, and having an insertion of 2 inches in breadth below the tubercle must exercise great power in its contractions, of rolling the radius back into a supine position, We next have to notice some muscles appropriated to the extensor motions of the the thumb, the first of which is the

## Extensor Ossis Metacarpi Pollicis

This muscle arises from the posterior part of the Ulna near its middle, just below the insertion of the anconeus, and after crossing the interosseous ligament also gets some fibres of origin from the radius, soon after which it becomes tendinous and crosses in front of the extensors of the carpus and long supinator and passing through a groove in front of the styloid process of the radius, is inserted into the metacarpal bone of the thumb near its base, The action of this muscle as its name imports, is to extend the metacarpal bone of the the thumb, the only metacarpal bone in the hand which is capable of the motions of flexion and extension, independent of the bones upon which they are supported, The next muscle is a much smaller one and is called the

## Extensor Minor Pollicis

Or extensor ~~secundi~~ primi internodii, This arises from the posterior and middle part of the ulna and from the interosseous lig-ament, after which it becomes tendinous and passes through the same groove and bound down by the same process of fascia, with the muscle last named, after which it is inserted into the second phalanx, or last bone of the thumb, The action of this muscle will of course be to extend the last bone and afterwards the whole thumb obliquely outwards. The third and last muscle of this extensor set is rather larger than this and is called

## Extensor Major Pollicis

Or extensor ~~primi~~ secundi internodii, It arises also from the posterior part of the ulna and interosseous ligament near the origin of the muscles last named, The tendon of this muscle runs through a distinct groove in the annular ligament, and has a distinct synovial sheath about it,- and goes to be inserted upon the back of the first phalanx of the thumb, Its action will be to extend separately this bone upon the metacarpal bone and afterwards to act upon the metacarpal bone. This muscle finishes the consideration of those situated upon the fore arm, and we next come to examine those upon the hand. Upon looking at the palm of the hand we observe two eminences upon it at opposite sides, these are called the thenar and hy-pothenar eminences, and are constituted of the muscles ~~and~~ bloodvessels fatty matter &c of the sides of the hand forming fleshy cushions by which the hand is adapted to the inequalities of the surfaces of substances which may be grasped, The strong palmar aponeurosis before mentioned extends its margins so as partly to cover each of these prominences so as to cover its vessels and nerves, Into the formation of the thenar or thumb side we have several small muscles entering, the first of which and the most external is the

## Abductor Pollicis

This little muscle arises from the os scaphoides, from the ligament of the joint and occasionally also from the trapezium, and in this case has also a slip from the extensor ossis metacarpi pollicis, from whence it is inserted into the outer side of the base of the first phalanx of the thumb, The action of this as its name imports will

be the abduction of the thumb. Under this we find a fleshy mass which constitutes the

## Opponens Pollicis

A flexor of the metacarpal bone of the thumb. This muscle arises from the trapezium and trapezoides and also from the annular ligament of the joint, and goes thence to be inserted into the whole length of the metacarpal bone of the thumb. The action of this muscle will be to rock the thumb over towards the fingers and as its name imports oppose the flexor action of the fingers. this is one of the muscles which add greatly to the use of the human hand as a prehensile instrument. The next muscle in this group which comes to our notice is the

## Flexor Brevis Pollicis

This is a double muscle, or digastric, being divided into two distinct portions by the long flexor of the thumb which passes through it. As it passes, this tendon has a strong sheath of synovial membrane surrounding it which as in other instances, is much larger than the tendon which it covers. These tendinous sheaths or thecae it is very important to notice and study, as I have before remarked, as they very frequently become the seats of disease. A case occurred to me some time since in which this theca became distended to such a degree as to oblige me to pass down a bistoury at the top of the swelling and lay open the sack throughout, in order to discharge the contents and eradicate the affection. The two heads of this muscle come off from different points, the first from the trapezium and trapezoides, and the second from the magnum and unciforme, from which they are inserted into the first phalanx of the thumb by the intervention of the sesamoid bones one on each side, the first head being inserted into the outer, the second into the inner one. The action of this muscle will be that of flexing the first joint of the thumb upon the metacarpal bone. Another muscle is attached to the thumb about this portion and is called the

## Adductor Pollicis.

This muscle arises from the side of the metacarpal bone of the middle ~~fore~~ finger, and is inserted into the internal sesamoid bone of the thumb or by it into the base of the first phalanx of the thumb. Its action is that

of drawing the thumb towards the fore finger or adducting it, Another muscle between the thumb and fore finger is the

## Abductor Indicis

This arises from the whole of the metacarpal bone of the thumb towards the hand, and is inserted into the base of the first Phalanx of the fore finger, By its action it separates this finger from the rest and draws it towards the thumb, upon the little finger we have some muscles which correspond in a degree to these, the first of which is the

## Abductor Minimi Digiti

This has its origin from the pisiform bone and the annular ligament of the wrist surrounding it, and is inserted into the upper end of the first bone of the little finger, which its action tends to separate from the rest, the

## Flexor Parvus Minimi Digiti

is a small muscle and arises from the unciform process of the os unciforme, and from the carpal ligament surrounding, and is inserted into the upper end of the first phalanx of the little finger, upon the palmar face, By its action the little finger will be flexed. In addition to these, there exist some small interosseous muscles, which it is only necessary to know the existence and general situation of. Of these there are seven in all, four upon the palmar and three upon the dorsal part. The first upon the palmar side is the

## Prior Indicis

which arises from the outer side of the metacarpal bone of the fore finger and is inserted by a slender delicate tendon into the base of the first phalanx, Then we have the

## Posterior Indicis

whose ~~origin~~ and insertion are the same only upon the opposite side of the finger, We also have the prior Medii and posterior medii which are upon the back and are double headed muscles having two points of origin, There are also a prior annularis and a posterior annularis, and an adductor indicis, whose origins and insertions are similar and unimportant except in knowing that they exist and that there is a considerable space in which they are placed, by which we are enabled to remove any one of these bones without necessarily involving the rest.

Lect. XXXIX.

I have upon another occasion shown you gentlemen, the distribution of the arm, and we have now to examine its further course down the forearm, and also the nerves which are distributed to the whole extremity. We have before noticed that the axillary artery sends off first the anterior thoracic branches to be distributed to the muscles and integument upon the chest, - the subscapular branch to the muscles beneath and upon the inferior part of the dorsum of the scapula, - the posterior and anterior circumflex arteries to the joint and surrounding parts, - and also the larger branch, which however, is sometimes as in the case before you divided into two, - called the profunda major which passes around the bone between two heads of the triceps extensor muscle to get upon the outer side of the arm where it is distributed to the muscles and anastomoses with the recurrent branches from the fore arm. Below this there is given off a small branch called the Nutritia which passing through the nutritious foramen is distributed to the bone. Next we have the Profunda minor or inferior a branch larger than the last but much smaller than the major or superior profunda. This is distributed to the surrounding muscles and joint. The last branch of importance given off upon the forearm is the Anastomotica which is nearer the joint being distributed to the surrounding parts and anastomosing by large branches with the radial recurrent artery. These anastomoses are only interesting and important as showing that the main trunks of the vessels may be occluded without necessarily obstructing the circulation to any great extent, these connections being sufficient to carry on the action necessary until they become enlarged by the increased flow. Thus we notice four branches upon the arm which have received names, there being a great number of smaller ones whose importance ~~is~~ is not sufficient to warrant a particular description. We then see the main trunk after passing the elbow joint dividing opposite the tubercle of the radius, into two large branches the radial and ulnar. The division at this point is however by no means constant, sometimes occurring as high up as in the axilla, and at various points between this and the tubercle of the radius which is the most common point. Here the radial branches pursues a straight course, appearing as though a continuation of the main trunk down the outer side of the fore arm to the wrist, whilst the Ulnar

runs off obliquely to join the ulnar margin of the arm along which it proceeds to the wrist joint. The radial soon after the separation throws of a branch which ascending the arm again is called the Radial recurrent, This is the branch which anastomoses with the profunda major upon the outer side of the joint, The ulnar also sends off a branch soon after the bifurcation which like that of the radial ascends to anastomose with the anastomotica upon the inner side of the joint, This is the Ulnar recurrent anterior to distinguish it from another small ulnar recurrent branch which anastomoses with the profunda minor upon the back portion of the joint and is therefore called posterior, These anastomoses are not merely capillary, but are continuations of large trunks from one to the other, thereby establishing a free communication. In its course down the arm the ulnar artery sends of a large branch called the anterior interosseal artery, which lies upon the interosseous ligament, and sends a considerable branch through to anastomose with a similar branch upon the posterior surface called the posterior interosseus artery. All these send off in their various courses branches to the muscles and surrounding tissues, The main Ulnar trunk after getting to the wrist joint passes in front of the annular ligament gets below the palmar fascia and crossing the tendons of the flexor sublimis, forms the superficial palmar arch which we have before noticed, which sends off a branch to the back of the hands and some anastomosing branches with the arteries below, and also some to the fingers called the Communicabal digital branches which by dividing again, supply each side of the fingers - running in considerable trunks along each side to end in the pulpy extremities which are thus rendered extremely vascular, Between the radial recurrent and the wrist the Radial artery gives off no branches of importance, before it passes under the extensor tendons of the thumb it sends of a branch called Dorsalis Carpi radialis to the radial side of the back of the hand, The main trunk then passing backwards under the extensors of the thumb gets between the metacarpal bones of the fore finger

and thumb divides into three branches, one of which is quite large and important and is distributed to the muscles of the thumb, This is the volar artery, which being when of the ordinary size, wounded will produce so much hemorrhage as to require a ligature to control it. The artery also sends a branch to the radial side of the index finger. The volar artery generally divides into two branches one of which is distributed to each side of the thumb. The remaining branch or main trunk of the artery dips in between the metacarpal bones of the thumb and fore finger and getting into the palm crosses over the heads of the metacarpal bones forming the deep seated palmar arch, terminating by anastomosis with the ~~deep~~ superficial palmar arch which we have before seen. From this deep palmar arch we have given of the magna pollicis to the thumb, and a branch called indicator to the ulnar side of the fore finger. The anastomoses which is so free between these vessels here gives rise to the great deal of hemorrhage which occurs when a wound is received in this part. We next come to consider the nerves of the arm which will complete its anatomy as we have seen the veins & shall see them now more particularly in relation with the superficial nerves. In studying the anatomy of the neck we saw that the Brachial or axillary plexus of nerves was formed by the anterior branches of the fourth fifth sixth and seventh Cervical nerves and the first dorsal, which by their branching and reuniting formed a network which from giving origin to the nerves of the arm had received that name. The third cervical nerve with sometimes a slip from the fourth gives origin to the phrenic nerve which passes down the neck to the diaphragm where it is necessary to respiration. This plexus has been here left with the artery and vein in order to repeat the impression before made upon you as respects their relative situation, The roots of the plexus lying behind the artery and the artery behind the vein Before the branches from the plexus run down to embrace the artery as we have seen in the axilla, it sends off a number of branches which must first be noticed. First we have a large branch called the supra scapular nerve running with the artery of the same name to supply principally the supra scapularis muscle. A number of small branches go off to supply the Pectoralis major and

minor muscles and the surrounding parts upon the chest these are called the anterior thoracic nerves, and are of not much importance. From the upper part of the brachial plexus, and in close connexion with the phrenic we have coming off a nerve of great importance, namely the long thoracic, or external respiratory nerve of Sir C Bell. This nerve is distributed to the serratus magnus muscle by which it becomes associated with the diaphragm in the function of respiration, for it comes partly from the third cervical and therefore from the same part of the spinal marrow with the phrenic, - The serratus magnus is thus made to raise the ribs, and become one of the inspiratory muscles. In addition to these there are generally some nerves given off from the lower part of the plexus called sub-scapular These may be very briefly described, they are generally three in number, and are distributed one to the latissimus dorsi, ~~and~~ another to the subscapularis, and a third to the infra spinatus and teres major muscles. There is often found the same number of supra scapular nerves but commonly as in this instance only one. There are here to be noticed some very singular nerves coming out from the interior of the thorax, called the intercosto humeral nerves. These are generally found coming through in the second and third intercostal spaces, sometimes also through the first. They are branches from the intercostal nerves, being connected with the great sympathetic system, and come out to communicate with the nerves upon the surrounding parts and to supply the skin upon the axilla and inner side of the arm. As the sympathetic system is that which supplies the viscera as the heart arteries &c. the distribution of these branches which have fillaments from that system will account for the peculiar numbness experienced in this part of the arm in such affections as angina pectoris. There are often three of these nerves which receive branches from the axillary plexus, and then send of a long branch to the integuments, which extends below the axilla. This is called the Cutaneous nerve of Wrisberg The next nerve given off is that large branch which we have before seen as the Circumflex nerve, which after giving off some branches in its course backwards around the neck of the humerus, is principally distri

-buted to the Deltoid muscle, We next come to the prop-er branches of the brachial plexus which are distributed to the arm, These are five in number, two of which, the Musculo Cutaneous, External Cutaneous, or perforating nerve of Casserius and the Median nerve lie principally upon the outer side of the artery, Whilst the Ulnar, Musculo Spiral and internal Cutaneous nerves lie upon the inside of the vessels, The Musculo Cutaneous or External Cutaneous, or perforating nerve, so called from being distributed to the muscles and integuments upon the outer side of the arm, and from passing thro-ugh the head of the coraco brachialis muscle, - is a nerve of considerable size, which gets upon the outer side of the arm through the coraco B. muscle to which it gives some branches, and passing down between the biceps and brachialis internus to which also it gives branches, At the outerside of the elbow joint it pierces the fascia and passes superficially below the median cephalic vein just where we often bleed, after which it divides into two branches and is distributed to the integuments upon the back part of the fore arm, hand, and thumb.

Next we examine the Internal Cutaneous, which is a much smaller nerve and comes of from the plexus in the axilla on the internal side of the arm, This nerve anas-tomoses with the intercosto humeral nerves, and is distrib-uted to the skin upon the internal side of the arm, as it proceeds down the arm nearly in the course of the bas-ilic vein, it divides into two branches one of which pass-es in front of the median basilic, which is the most inter-esting feature in the distribution, as it is always liable to be cut in the operation of bleeding, Thus we see that upon each side there are nerves crossing the course of these superf-icial veins, but only upon the inside is the nerve in front, thus if by chance one of these should be cut in the operation you may say it was not your fault but the fault of the distribution of the nerve, No one being able to say certainly beforehand that he shall not cut one of them, This nerve is distributed to the inner side of the arm and forearm as far down as the wrist, there being almost endless varieties in its arrangement as is shown by the preparations and models upon the table, The next nerve for consideration is the Median, which comes off from the plexus by

two roots which ordinarily span the artery in the upper part of its course. This nerve sends of no branches in the upper part of its course, lying upon the outer side of the artery, and as it gets down below the bend of the elbow crosses the artery in nineteen out of twenty cases in front of the vessel, but in this one it goes behind it. These anomalies although rare should always be remembered as sometimes occurring, otherwise any operation upon the vessels might be embarrassed by not finding the vessels exactly where they are looked for. This position to the ulnar side of the artery is afterwards maintained throughout its course, which lies between the flexor sublimus and profundus. It gives off one or two branches to the muscles of the fore arm, and after passing under the annular ligament gives off one called the superficial palmar. After passing under the ligament under the superficial vessels it gives a branch to the back of the hand, one to be divided for each side of the palmar surface of the thumb, - one to the mass of solar muscles, - one to the thumb side of the fore finger, and one which splits and goes to supply the ulnar side of the fore finger and the adjoining side of the middle finger. It then anastomoses with a branch from the ulnar and sends a branch to the ulnar side of the middle and adjoining side of the ring finger. Thus we see that this is the peculiar sensation nerve which is mainly distributed to the thumb, fore and middle fingers, and with a microscope we can see upon its filaments small ganglionic enlargements which increase its sensitive power doubtless. This nerve particularly the part distributed to the fore finger, is very subject to neuralgias, which have been attempted to be relieved by cutting down upon and removing a part of it, - but without much success, as is commonly the case in such modes of treatment. The branch which is sent to the dorsum of the hand is, distributed to the integuments and anastomoses with the ulnar and other nerves which run to that part. The ulnar nerve passes down the arm upon the inner side of the triceps muscle and as it crosses over the elbow joint in the groove between the olecranon and the internal condyle becomes very superficial, lying only between the skin and bone. It is from this exposed situation that it

so often receive those shocks which send a thrill thr-
-ough the inner side of the arm and hand, This is a
peculiarity of injuries of the nerves, that the effect is not
experienced at the injured point but rather in the course
of the distribution of the nerve, for in this jar of the
elbow we do not feel the sensation at the point stru-
-ck, except as the integuments are affected, but we
feel the peculiar sensation over the whole inner part
or ulnar margin of the fore arm and hand, Just
431 as it passes down over the elbow joint we observe a
ganglionic enlargement, which are common upon nerv-
-es, in the neighbourhood of joints, and which doubtless
serve some purpose of increasing the power or efficiency
of such nerves. After passing the joint it goes between
the two heads of the flexor carpi ulnaris and gets into
company with the ulnar artery about half way down
the arm, with which it continues until it reaches the
wrist, In this course from the plexus it sends off a
branch or two to the triceps and internal part of the arm
and some of a smaller size to the muscles upon the ~~out~~
upper part of the fore arm, Above the wrist joint it
906 sends off a branch to supply the integuments upon the
back of the hand which anastomosing with other filam-
-ents is continued on to the little and ring finger This is
called the Dorsalis nerve and receives additions from the
radial branches across the hand. The main trunk then
proceeds in company with the artery over the annular liga-
-ment to the outside of the os pisiforme, into the palm where
it is very superficial and divides into two branches, a
deep seated and superficial palmer, The latter after
sending a branch to the palmar fascia, gives one to the
ulnar side of the little finger, and another to the radial
side of the same finger and adjoining ulnar side of the ring
finger, It then anastomoses with the median as before
noticed and supplies the adjoining sides of the middle
and ring fingers, The deep seated branch supplies prin-
cipally the interosseous muscles accompanying the deep
palmar arch in its course across the palm, Thus we
notice that the ulnar nerve is distributed to those
fingers upon the ulnar side of the hand which the
median did not supply, and also the whole palmar
surface of the ulnar side of the hand, The most

and last of the nerves of the arm is the musculo Spi-
-ral, This is a very large nerve usually next in size to
the median, but in this subject even larger than that
nerve, It derives its name from being principally dis
-tributed to muscles, and from the very spiral course
which it takes down the arm, which is very percept
-ible upon any of these preparations, It passes from the
plexus downwards and backwards between two heads
of the triceps muscle, thus getting spirally upon the
outside and opposite point of the arm, where it pass
-es in the groove between the supinator radii longus and
brachialis internus down across the joint, Soon after
getting upon the fore arm it divides into two branches, one
Called the superficial and the other the profound or
posterior interosseous nerves, Before this bifurcation
however it sends of a shower of muscular branches to
the muscles in its route, and just above the joint a
long branch called the ramus superficialis dorsalis
or Spiral Cutaneous which supplies the integuments
of this part of the arm, The anterior or superficial inteross
-eous branch then runs down with the artery distributing
branches to the muscles and integuments in its Course
and is finally distributed to the radial part of the
hand. The larger or posterior interosseous branch pier
-ces the the supinator brevis muscle and the interosseous
ligament to get upon the back part of the arm, Here
it is divided into two branches one the proper posterior
interosseous or Ramus dorsalis profundus, to be distribu
-ted to the deep seated muscles upon the back of the
arm and the other supplies the remainder of the mus
-cles and integuments, Thus we see this muscle is prin
cipally appropriated to the mass of extensor muscles
upon the forearm, The terminal branches of this post
-erior part however proceeds on down to the back of
the hand being distributed to the integuments, then un
-der the name of the dorsalis manus, It however receives
anastomotic branches from other nerves, The radial branch
which follows the artery only for a short space in the
middle of the arm gets upon the back of the hand
and has the same ultimate distribution into the integ
-uments upon the back of the hand and fingers, even supp
-lying the roots of the nails which are so sensitive,

Lect. XL.

great Space

Between the lower margin of the ribs and the Crest of the ileum and pubis, in the dried skeleton there is a great space existing, the upper and lower parts being connected only by the vertebral column, As in the normal condition this space is filled by important viscera these must be confined in their position by some kind of parietes which from their functions in the human economy must be of a yielding nature, To these soft parietes of the abdomen then I propose to direct your attention to day. This Space in the various species of animals, - between the ribs and pelvis, varies very materially, for whilst in some the the ribs do not extend far down, - in others the extend entirely to the pelvis leaving no space to be filled up by muscles and aponeurosis. The change in the size and position of the contents of the abdomen in man however, make it necessary that these walls should be strong, at the same time that they may accommodate themselves to all the vary-ing circumstances under which the changes of his economy place him. Thus one portion of these walls above and below being fixed and immovable with regard to capacity afford a firm support or attachment to others which are on the contrary highly movable, and whose motions are indispens-able. The shape of this space thus filled in by the yielding walls, is that of a lozenge somewhat, being bounded by four sides and four angles, One of these angles is at the point of the sternum, another at the pubic symphyses, and the remaining two between the last ribs and the Crest of the ileum upon each side, - the lines bounding it being the margins of the ribs and the Crest of the ileum upon each side. The axis of the abdominal cavity and that of the pelvic cavity are not the same, - the first being nearly vert-ical if extended would strike the symphyses pubis whilst that of the pelvis would emerge from the abdominal cavity below the umbilicus, - by this we see that the we-ight of the contents instead of pressing immediately upon the contents of the pelvis, is thrown by this obliquity of its axis, upon the symphysis pubis, and hence we see the necessity of these parietes being very strong particularly at this point where they have the additional resistance to overcome, (of gravitation). The muscles by which this arran-gement is fullfilled are five in number upon each side - three large broad, and two narrow ones placed at each side of the median line. Immediately above

weight on Symphysis P.

the centre of the abdomen there exists a line at which many of the tendons meet, which is strong and wholly tendinous. This from its white colour is called the linea Alba; and has been described by some anatomists as a great ligament by which the thorax and pubis are attached to each other, and called sterno pubic ligament. The five pairs of muscles of which we have spoken consist first of a large broad one running obliquely downwards and inwards called the Obliquus Externus descendens, - secondly of another one of equal dimensions extending from below upwards and inwards and called Obliquus internus ascendens, - and thirdly to close up the lateral angles a broad and extensive muscle whose fibres run transversely, which is therefore called transversalis abdominis. These three are precisely so arranged as the best to fill up the angles and inequalities in the space, and be at the same time capable of producing powerfull ~~extent~~ effects by their contraction. To give strength and the power of contraction to the anterior wall near the middle line, which otherwise would have been entirely tendinous we have another muscle placed vertically at this point. This is a narrow muscle in comparison with those noticed and is called the Rectus abdominis. This is associated at its lower extremity with a smaller muscle, which is however very often absent. This muscle is of a triangular shape with the base downwards and is called the Pyramidalis. This we need not now notice particularly as we shall have to revert to it in regular succession. Now the whole abdomen, beside the integument is covered by that superficial fascia which we have so often noticed upon other parts of the body. This is here of more importance than in some other situations, as it forms one of the coverings to a hernial protrusion whether occurring at the umbilicus or at the groin, and must of course form a part of their anatomy. The superficial fascia is here filled with fatty matter, not deposited in the cellular tissue as is often said in descriptions, but deposited in the appropriate adipose membrane or tissue which exists in the fascia. When we turn this off, which as you see forms a complete envelope to the whole abdomen as the skin does we bring into view one of the muscles before noticed as appearing first, namely,

Linea alba

5 pairs of muscles

S. F. more important here

the **Obliquus Abdominus Externus**
or decendens with its tendon, We have here to notice first
the meeting of the tendons in the center to form the linea alba
- this whiteness is produced principally by a decussation or inter
L. A -locking of the tendinous fibres of the two sides which of course
increases the muscles at this point and therefore increases the
L. Semil silvery tendinous appearance, Beside this line we have another
line presenting the same colour to a less degree, this extends in
a curved direction with the convexity outwards, from the end
of the sternum to the pubis and is called the linea semiluna
-ris, It is produced by the joining of the tendons upon the exterior
border of the Rectus muscle, which tendons are much thinner
as they pass in front of the muscle, allowing its colour to
appear through, These Tendons from the outer side of this
muscle are sometimes described as a distinct fascia enclos
-ing the muscle, into which the other muscles are inserted,
but as we shall soon see the distinct tendons of each muscle
may readily be demonstrated to the linea alba. We also
L. T usually notice other lines crossing the abdomen in a trans
-verse direction, and thence called lineae transversae, These
are generally four in number and may be here faintly seen,
Through these tendinous expansions blood vessels must of
course pass to supply the skin and tissues beneath, and
accordingly we have them perforated with small holes as
though made by a punch, through which this object is eff
-ected by vessels and nerves from the intercostals + lumbar trunks, In sp
-eaking of the Pectoralis major muscle we had occasion to
speak of a slip passing from the obliquus muscle to this
-and this slip we here notice again in commencing our ex
-ammination of the origin of this oblique muscle, Then after
Incordif noticing this continuation of fibres with the pectoralis we find
it coming from the eight (sometimes only seven) lower ribs
by fleshy slips, the five uppermost of which interdigitate
with the origin of the serratus magnus, so as to fill up the
saw-tooth-like niches left by that muscle which we be
-en examined, The three lower fleshy slips interdigitate
origin with, or rather are overlapped by the the points of the lattis
-simus dorsi which we have also seen to come from the
lower ribs. In this case however there are four of these lower
points opposed to the latter muscle, making nine points of
origin in all, From this extensive origin the muscle pro
-ceeds downwards and inwards, having filaments of tendon

gradually formed upon it, until these becoming seminary and lying side by side form the tendinous expansion of the muscle which is inserted as follows. The upper and middle portions are inserted with that of the opposite side into the

Insertion linea Alba, whilst the part which comes from the lumbar region is inserted into the anterior two thirds of the crest of the ilium by the outer lip or facet. There are other fibres of the tendon whose obliquity permits them to pass the crest of the ilium, and yet which cannot reach the linea alba. These pass down to be inserted into, or to form a ligamentary

Il. P. lig band which is stretched across from the superior anterior spinous process of the ilium to the symphyses of the pubis. This is what has been called severally Poupart's ligament, the ligament of Fallopius, and the ileo pubic ligament. It consists of a band of ligamentous or tendinous fibres whose lower margin is folded in and does not present a sharp edge, and may be considered as an independent ligament which receives the insertion of the muscle, or which is per-haps as simple a way of viewing it as any, - may be regarded as a simple extension of the tendon of the external oblique across this part to be inserted upon the spine of the pubis, whose lower or free margin is folded in and inserted for ¾ of an inch in a backward direction upon the ~~spine~~ commencement of

Lig of Gim the ~~pubes~~ linea Ileo Pectinea forming the ligament of Gimbernat which we shall have to examine more closely in relation with the parts ab-out the groin. Either mode is quite intelligible, and may be adopted, considering the ligament coincident with the fold of the groin, and a continuation ~~of~~ or forming an attachment for the fascias of the upper part of the thigh. Many anat-omists consider Poupart's ligament as consisting of a wide plane of fibres of this tendon, and therefore say in their descriptions that it splits into two columns as it app-roaches the pubis to form the external abdominal ring, but this is not the case, as Poupart's ligament has nothing more to do with this opening than to form a part of its

E. A. Ring lower boundary, the upper fibres being a part of the tend-on simply. This ring is rather to be considered as the result of a difference in the direction of the fibres of this portion of the tendon. Thus one part run down to then be inserted on the pubis and form Poupart's ligament whilst another set running more horizontal, cross the median line to be inserted upon the opposite pubis

bone, This difference of course, must naturally leave an opening at the lower part of this route, and this is the external abdominal ring through which passes the Spermatic Cord of the male and the round ligament of the female, It is somewhat oval in shape being broader at one extremity than at the other, and this base is always the end next the pubic bone, This is not a simple hole, as if it had been cut out by some instrument, but in the natural condition is closed by a process of Cellular tissue called the intercolumnar fascia which coming off from its sides goes down upon the Spermatic cord and forms one of the coverings in inguinal hernia which must be taken into consideration, Upon the external side of this tendon, and having an insertion into the linea alba, we here notice a mass of condensed cellular tissue proceeding down towards the scrotum, This is the suspensory ligament of the penis, and is noticed merely incidentally in order to show the perfect obeyance which it is under to the abdominal muscles, so that by relaxing them as in a stooping posture this ligament is always relaxed, Thus we notice the extensive insertion of this external oblique muscle from the sternum down the linea alba across Poupart's ligament and upon the anterior half or two thirds of ~~[illegible]~~ the crest of the ilium, The action of this muscle will be to compress the side of the abdomen and force the viscera against the spine, and by its connexion with the pelvis to flex it upon the spine, or by drawing down the ribs when the pelvis is fixed to curve the body forwards, and one side acting, to one side, From its antagonism to the diaphragm it will act as an expiratory muscle by forcing the viscera up against the diaphragm forcing it to retreat into the thoracic cavity We now raise the muscle from its origin, raise up Poupart's ligament, divide the fascia and turn the muscle in upon the middle line, when we have brought into view the second large muscle of the abdomen namely the

prolapse

## Obliquus Abdominis Internus

or ascendens, which extends back into the lumbar angle of the space, This has its origin by the intervention of the strong lumbar fascia from the three or four lower spinous processes of the loins and also fleshy from the anterior two thirds of the crest of the ilium by its middle lip or front, extending down upon Poupart's ligament for two

thirds of its length externally also fleshy. From this extensive origin the fibres take various directions accordingly as they are inserted at different points. The external fibres run obliquely upwards and inwards to be inserted serially into the cartilages of the twelfth, eleventh, tenth, ninth, and sometimes into the eighth ribs, - the more internal parts of the muscle are inserted, as the fibres become more and more horizontal in their descent into the whole length of the linea alba until finally the lower fibres or those arising from Pouparts ligament descend obliquely and are inserted with the ligament upon the pubes, thus forming a muscular arch ~~through~~ under which passes the spermatic cord in its route to the external ring. Thus we see if the origin of the mus-~~cular~~ fibres had extended the whole length of the ligament this cord, to escape would have had to pierce the muscle which in its contractions must then have pinched it, an action which its delicate structure and functions would not bear. The action of this muscle is very similar to that of the external oblique only exercised in a different direction, yet aiding in accomplishing its functions. As we raise this muscle from its position at the lower part of the abdomen we bring into view lying between this and the transversalis beneath, the circumflex ilii vessels which here determine the thickness of these two muscles, for if these vessels are deeply seated as in the present case we have the internal oblique upon them exterior thick and strong, whilst if the converse obtains it is thin and the transverse is thick. As we raise this muscle where it spans the cord we bring into view another small muscle which passes down the cord, appearing like a continuation of some of the fibres of this muscle, which they really are, but as there are also many other independent fibres it is to be considered as a distinct muscle. This is the cremaster muscle which we shall have partic-ularly to notice at another period as concerned in drawing up the cord and testicle. As we go on raising up the internal oblique we have another large muscle brought into view namely the

## Transversalis abdominis

This has an origin still more extensive than either of those considered, passing across the abdomen in a trans-verse direction as its name imports. It arises above

from the whole costal border of the thorax from the inner margin of the cartilages of the ribs, from the transverse and spinous processes of the lower dorsal and four upper lumbar vertebrae, from the anterior two thirds of the crest of the ilium by its inner lip, and from one half to two thirds of Pouparts ligament, From all these points the fibres run transversely to be inserted by an aponeurotic expansion into the linea alba, The lower fibres of this muscle like those of the one last mentioned form an arch under which the cord passes out. The action of this muscle is that of compressing the abdomen like a broad girt, forcing the viscera back against the spine, It of course can have no action of flexion but is important not only as an expiratory muscle, but also in the acts of defecation and micturition which it very much aids by compressing the contained viscera firmly within its grasp, The action of this muscle when violent may be a very efficient cause of sudden hernial protrusions which sometimes take place at the inguinal femoral or umbilical rings, Its antagonism to the diaphragm by alternating in action with it is a great agency in respiration, and the contraction of both these together makes the great expulsive power in voiding the excrement and urine as above noticed, We notice beneath this muscle an expansion of fascia between it and the peritoneum, This is the Transversalis fascia, & from first having been well described and understood by that surgeon is sometimes termed the fascia of Cooper, This however we shall have to examine more closely hereafter and may therefore pass on to the consideration of the two muscles remaining, namely first the

## Rectus Abdominus

which is exposed in its entire course by laying back a portion of the tendons of the muscles before considered, This we find getting its origin from the body of the pubic bone immediately adjoining the symphysis by a space not more than an inch in breadth from which it increases in breadth and size as it proceeds directly upwards along the middle line of the abdomen in contact with its fellow of the opposite side if it was not for the joining of the tendons to form the linea alba, It is inserted in this as in a great many instances into the xyphoid appendage of the sternum and adjoining cartelages of the 5 6 & 7th ribs, In the course of this muscle upwards occur those four

transverse white lines before noticed, which consist of tendinous fibres inserted in various parts of the muscle dividing it into separate portions, - these portions under certain morbid circumstances as Cramp Colics are found to contract separately, but of the use of these divisions no one as yet has been able to treat satisfactorily. The Action of this muscle is clearly that of flexing the thorax upon the pelvis, or if the individual be lying down to bend the body so as to draw up the pelvis. This muscle in its course up the abdomen gets a sheath which is formed of the tendons of the other abdominal muscles, in a peculiar manner which I shall now endeavour to describe. The tendon of the external oblique muscle runs entirely across in front of the muscle to the linea alba, That of the internal oblique when it arrives at the edge of the muscle splits, one half running in front with that of the external muscle, and the other behind, the two parts meeting again at their insertion into the linea alba, The transversalis tendon also proceeds straight to the middle line behind the muscle and the posterior layer of the internal oblique. Thus it is obvious that one entire tendon and a half run both before and behind the muscle, and that its proper sheath is formed by the splitting of the tendon of the internal oblique muscle, The next muscle for consideration is the

## Pyramidalis

This is very frequently deficient, particularly in the black, where anomalies of all kinds are more frequently met with than in the white varieties, This muscle is named from its shape and arises from the pubic bone enclosed in its distinct sheath it ascends, growing narrower, and is inserted into the linea alba about halfway between the umbilicus and pubis, It acts as a tensor of the linea Alba, as all these fascias have their appropriate tensors. - The arrangement by which the Rectus muscle gets its sheath during the upper part of its course does not hold good here below, for, from a point half way between umbilicus and pubis we have only the transversalis fascia behind it, strengthened by some tendinous fibres, - the other tendons of the internal oblique and transversalis ending abruptly at this point of the line.

Colic

Tendons

Tendons

**Lect. XLI.** Having at our last meeting shown to you, gentlemen, the abdominal muscles, or those which are concerned in the filling up the lozenge shaped space left vacant by the bones of the trunk, I propose to day to consider their attachment to the bones of the pelvis, with the agency which they have in inguinal Hernia, in other words, to point out the particular anatomy of the parts concerned in this variety of Surgical disease, which it is so important clearly to understand before attempting its relief. The skin of course must always cover the outer face of the tumour, and next we must find the superficial fascia, which we have noticed so often as covering every portion of the body being here continued down upon the thigh from the abdomen, without any more change or interruption than is met with in the skin which covers it. After turning aside these constant coverings which are always to be first taken into consideration, we come down upon the tendon of the external oblique muscle. This we have before noticed as forming the ligament of Poupart by its extension in a round cord like form from the anterior superior spinous process to the pubic bone. This ligament does not exist here in the form of a definite margin in the groin but is attached to or continuous the strong fascia of the thigh called the Fascia lata femoris; this fascia binds down the ligament in connection with the parts beneath. We have seen that this tendon of the external oblique is inserted by one part forming the ligament of Poupart, upon the spine of the pubis, and by the part immediately above this, upon the pubic bone of the opposite side, thus making a difference in the direction of the fibres of the two parts. This divergence necessarily leaves an opening at the lower and inner part of the tendon through which passes the Spermatic cord. This is called the external abdominal ring, but is not a ring, being rather a triangular shaped opening with the base upon the os pubis and the apex pointing upward and outward. The columns of this ring as its sides are called, are formed the upper by the portion of tendon which crosses over to the opposite pubic bone, - and the lower, by Poupart's ligament, or the portion inserted on the spine of the corresponding pubic bone. The insertion of the portion of tendon forming Poupart's ligament however does not

stop upon the spine of the bone, but is continued for three quarters of an inch back upon the crest of the pubis to form what is called Gimbernat's ligament. In the natural condition of the parts, we do not find this external abdominal ring open and the cord passing loosely through it as for clearness has been represented in the dissection of this side, — for such free openings, as though a portion had been cut out, rarely exist in the animal economy, there almost always being a gradual gradation from one tissue into another than this abrupt termination. On the opposite side of the subject the natural condition of these parts is preserved, and you notice that from the edges of the opening in the tendon all around it there comes of a process of thin fascia which gets upon the cord and forms a membranous sheath for it all the way down to the testicle. This is called the intercolumnar fascia, and when the finger is passed down the cord, through the passage, is capable of being dilated by it, and thus it is with a hernial protrusion which comes down in precisely the same manner, so that you see that this intercolumnar fascia must form one of the coverings of the bowel or omentum. When the tendon of the external oblique is turned down over the thigh, we have its insertion into the pubic bone displayed, and can see distinctly the portion which forms Gimbernat's ligament. This portion from its oblique direction backwards as you see forms the floor upon which the cord rests in its passage over Poupart's ligament, or through the canal. This Gimbernat's ligament is very variable in size, sometimes being very small, at others quite large — extending back for 3/4 of an inch upon the ilio pubic line. I have often felt it small and contracted in the operations for strangulated hernia in this region, and its diminutive size I think may give a predisposition to the occurrence of hernia, for when it is broad and large as in the specimen before us it is certainly next to impossible that a protrusion should take place at this point. The consideration of this species of hernia does not belong to the lecture of to day, merely noticing this ligament as being a portion of that of Poupart's inserted along the crest of the bone. Between the tendon and the parts behind we notice, when it is in place

a kind of grooved space running towards the external ring. This is the route of the spermatic cord as it passes obliquely downwards to reach this opening whence it passes down into the scrotum, This groove is also the course of hernial prot-rusions, for following as they do, the cord, the boundaries of its passage must be the boundaries of a ~~a~~ hernia; Thus we have seen that the anterior boundary of the cord is the tendon of the external oblique, and the floor upon which it rests is ~~Gimbernats~~ Pouparts ligament, From the external ring we trace the cord upwards and outwards for a distance of one and a half to two inches when it suddenly disappears from view, and we have next to examine into the manner of this disappearance We know that the constituents of the cord, namely the vas deferens, spermatic artery vein and nerves, all belong to the cavity of the abdomen, and that they must therefore get into it in some way, This it accomplishes by piercing the trans-versalis fascia through an oval opening concave upon its low-er side; This opening which we have here exposed to view is the internal abdominal ring through which the cord passes from the abdomen, and through which also must pass the bowel or omentum in ordinary oblique ~~inguinal~~ hernia; This ring is found exactly in the direction of a line from the anterior superior spinous process of the ilium to the symphysis pubis, and about midway of this line, and about half an inch above pouparts ligament as it crosses over to the pubes, This breach in the fascia is no more than the external one, a simple hole in the membrane, but like that has a prolongation of thin fascia sent off forming a funnel shaped sheath around the cord as it passes through, This is called the infundibular fascia, and makes a second covering which the cord gets from the rings through which it passes This transversalis fascia runs after being thus pierced by the cord, to be inserted upon pouparts ligament and at the edge of the rectus muscle, and must therefore of cou-rse form the posterior boundary of the canal which is called severally Inguinal, abdominal, and Spermatic, We have next to observe the relation which the fibres of the internal oblique and transversalis muscles have to the passage of the cord, We have seen that a number of the fibres of these arise from the outer half of pouparts ligament and are extended over in the form of an arch to be inserted into the pubic bone. This arch is no doubt formed for the purpose

of keeping clear of the cord in its track through this part of its course, for had these muscles arisen from the whole of the ligament or run straight along it, the cord would have been always subject to compression, and the testicle which in the foetus is an abdominal viscus, could not have got into the scrotum except through the fibres of this muscle, — Such compression upon the cord must have greatly interfered with its delicate functions and given rise to disturbances incompatible with its uses. These muscles when in their natural state as you see, hide completely from view, the internal abdominal ring, and we may readily see the very great advantages arising from this, in the prevention of the hernial protrusions. For they act here as a constant truss, just in the same manner that the hand would act placed over the ring to prevent this occurrence, not making great pressure in the natural position, but as soon as any attempt is made to throw them from the straight line their strong action is manifest, These muscles overlap the cord therefore and form the roof as it were to the canal or passage through which it passes, — the tendon of the external oblique forms the anterior wall and the transversalis fascia the posterior, whilst Gimbernats ligament forms the floor. There is a band of fibres passing down upon the cord which appears to come from the edges of the transversalis and internal oblique muscles where the cord passes beneath them between the two rings, These pass down around the cord and form loops around the testicle afterwards coming up to be inserted into the os pubis near the symphysis. This muscle has been supposed to originate by the testicle becoming entangled as it was drawn down by the gubernaculum of which I shall have to speak hereafter, — in the fibres of the muscles as it passed under them, and drawing down some loops along with it, and many of the fibres do certainly come from these muscles at the point where the cord passes beneath them, but there are other fibres which cannot be traced to this source, and as the muscle, which is called the cremaster, has the distinct office of supporting and drawing up the testicle, it does not appear probable that such accident alone determines its existence, In cases of old hernias

from the weight which it has to support, it very frequently becomes enlarged, and in the specimen upon the table it exists as a very large muscle, enclosing the sacke upon both sides. This specimen would render it difficult to suppose that its existence was a mere accident. From what I have said of the origin and course of this muscle it will be seen that it must give another envelope to the cord and consequently to the hernial sacke. From its origin within the canal and between the rings it will also be seen that it must form a covering to the infundibular fascia but beneath the intercolumnar fascia lying consequently between them. Although these thin fascia may sometimes be raised as separate coverings to a hernial protrusion, yet it is not always the case, they generally being fused together, and described as one investment under the name of tunica vaginalis communis. Thus we see that there is no certainty as to the number of distinct coverings which may be found upon a hernia, and hence the general rule which is never to be departed from - namely to cut down tissue by tissue until we come upon the protrusion, raising each with as much caution as if it were the last. It may now be asked what we have to prevent a hernial protrusion from coming directly out at the external ring without taking this oblique course through the canal of the spermatic cord. - and to answer this we must examine into the condition of the parts directly within the ext. abdominal ring, for although we do meet with with those which are called direct inguinal hernias, their proportion is not greater than one out of twenty to the other forms. At the lower and inner part of the inguinal region we have the tendons of the internal oblique and transversalis muscles uniting to form a strong dense tendon which is inserted into the linea alba and os pubis. This then which is called the conjoined tendon, passing behind the external ring, effectually prevents the bowel or omentum from getting through the ring without forcing before it this strong membrane and in a great majority of the cases which occur of direct hernia this actually takes place, and thus the number of coverings is again complicated. When a predisposition to hernia occurs it will take place of course at the weakest point and if the resistance is less at this point, than at the internal ring, which is seldom the case; the protru

sion will occur here. In a perfect conformation of the body where each tissue exists in a proper proportion and condition a hernia could not be supposed to occur, but from malformation, or diseased conditions, or sometimes from hereditary predisposition, these accidents frequently occur. The fascia transversalis is connected at the edge of the conjoined tendon, and aids in strengthening it. When the direct form of hernia does occur, pushing the conjoined tendon before it, the tumour from the resistance of this tissue cannot be very large, and must leave the cord on the outside ~~o~~ directly in front of it, or as I have seen in some cases spread the ~~tendon~~ constituents of the cord out so as to make it form a covering to the tumour. Of Course this form would essentially modify the condition of the parts over the tumour, in case of cutting down upon it, making a great variation of the coverings, from the cord being in different relations with the tumour. Hence again the application of the general rule to ~~cut~~ raise and divide layer by layer until the tumour or sack shall become exposed to view. A case occurred in the practice of Dr Rohen of this City in which I was called in Consultation, where in the attempt to form a direct protrusion the resistance was so great as to turn the bowel from its course out to the edge of the conjoined tendon around which it formed an elbow, and projected up to form a tumour the size of the end of a finger, which became strangulated and gave rise to the ordinary symptoms. Upon seeing this and recognising the condition of the parts giving rise to it, I directed the patient to bend forwards and relax the abdominal muscles as much as possible, when by making pressure in the line or direction by which the tumour appeared, succeeded in reducing it. These points should always be remembered as such cases may occur at any time, and may require operations for their relief, which would be modified according to these circumstances. We have seen that the transversalis fascia passes down from the internal ring to be inserted into Poupart's ligament and into the conjoined tendon, and above we trace it in contact with the peritoneum or only separated from it by some loose cellular or fatty matter, between the peritoneum and this transverse fascia running up

in this loose cellular substance, an artery of the utmost surgical importance with regard to the operations necessary for the relief of strangulated hernias. This artery I now expose to view, and as you perceive it lays very deeply in or under the surrounding parts being separated from the cavity of the abdomen only by the peritoneum. It is very fortunate that it is situated thus deeply, otherwise it would be liable to be cut in the wounds which frequently occur about the lower part of the abdomen. A case occurred at the hospital on the last clinic day after the class had been dismissed, in which a patient in a suicidal attempt, cut across the lower part of his abdomen very deeply, dividing the tissues all around and over this artery without cutting it from the fact that it lying over a yielding surface gave way before the knife and thus escaped. This artery runs upwards and inwards between the abdominal rings but nearer to the external, and in this course forces the peritoneum to project into the abdomen making a kind of falciform ligament or fold of peritoneum which is kept distinct by the artery and its two veins. This ridge or fold divides this part of the abdomen into two deep grooves or pouches, one leading to the external, the other to the internal ring. In each of these the investing peritoneum lies loosely, so as to offer considerable facilities for protrusion at either point, - the pressure of a finger only being necessary to produce a protrusion. Now the division of this artery in the operation for hernia would if the vessel was not afterwards tied lead to a fatal result in almost every case for the loose cellular tissue here would hold a quart of blood without making any show, and this would give rise to so much disturbance as to result most disastrously to the patient. The position of this vessel between the two rings is very important, and cannot be too carefully studied as a slight inattention in this respect might very readily give rise to very serious complication of an operation which in its own nature is not of a minor nature. In operating for a hernia having ascertained that the internal ring was the seat of stricture after dividing all the coverings, the knife may be introduced upon the finger and knowing that the internal ring is the seat, we might think it perfectly ~~straight~~ safe to cut outwards knowing the artery to lie to the inside of the

internal ring, but this will not do, for it has been proved, that in numerous cases particularly of old hernia the weight of the sack and contents has drawn down the internal ring until it becomes exactly opposite to the external one, and then if we cut outwards we should invariably divide the artery. Hence the rule has been adopted by all practical surgeons, to cut directly upwards in the direction of the course of the vessel, no matter under what circumstances they may be placed. This we may see renders it the next to impossible to cut the artery, unless it run an anomalous course. We notice here that covering all the fossa through which hernias occur, we have a continuation of the peritoneum, and hence that the protrusion must always push before it a fold of this peritoneum which as hernias are very long usually in process of commencing, gradually adapts itself to the condition, from lying loose in the fossa when the first attempt is made. This pouch of peritoneum is always present in hernias except the congenital form occurring × in children at birth, - and hence forms a constant covering to the bowel or omentum. Indeed it forms the proper sack of the hernia, - This pouch after getting through the passage expands to hold the contents of the bowel, whilst that part still in the canal, is of course contracted and thrown into folds. These folds by the pressure give rise to inflammations and effusions of lymph which glue them together and form bands which in nineteen times out of twenty are the cause of stricture, which is then said to be situated in the neck of the sack, or this narrowed portion. This of course occurs first at the internal ring where the most restricted portion of the sack is found and which constitutes the true neck where the plaits are pressed most closely together. Hence how important is it to know the position of this artery and never to vary from the rule laid down in cutting, as where the table is a perfect example where the enormous weight of the hernia could not fail to drag every thing down with it to the lowest point, making the openings of the two rings perfectly coincident so that the cord in its passage must form an elbow in order to escape through the opening.

Lect. XLII.

Having shown you the walls or parietes of the abdomen as well the bony as the muscular structures, which compose them, I propose to day to direct your attention the viscera or contents of the cavity called the Abdomen. In the first place there is no such thing as a cavity existing, for it is a plenum, - a space of which every portion is occupied, if not by the viscera, by some solid or fluid substance which replace them, the walls or parietes being in direct contact with the contents without the intervention of any unoccupied space. It is therefore a misnomer to say "cavity," although it is generally used, but without the signification of vacancy. But it is a convenient thing & allusive term as we say the Sun rises & sets. The viscera contained in this so called cavity are divided into solid and hollow, - and to accommodate the ever varying condition of the latter, it was absolutely necessary to have the parietes yielding or movable. This so called cavity is so large and contains such a variety of organs and viscera, that for the purpose of facilitating descriptions, and localizing various affections and phenomena, - as well as to simplify the understanding of it, it has been subjected to various arbitrary divisions by which it is mapped off. In the first place a line is drawn from the extremity of the ninth rib upon one side, to the same point opposite to it, - A second line also transverse, is then drawn from a point just above the anterior superior spinous process of the ilium of one side to a corresponding one on the other, These two lines divide the whole space into three regions, an upper, middle and lower, - A vertical line is next drawn from the same end of the ninth rib above to a space midway between the two anterior spinous process of the ilium, This repeated upon the opposite side and the ends of the lines extended beyond the points mentioned, will subdivide the three divisions first made each into three, making in all, nine, three middle, and three lateral upon each side of them. Those in the middle are called, - the upper or first, - the epigastric as it contains principally the stomach, a portion of this situated in a semicircular direction around the lower cartilage of the sternum, is called, from the fact that the heart may here be felt pulsating through the diaphragm, - the scrobiculus cordis or pit of the heart, The next division below the upper transverse line, or the centre region of all is called the umbilical region as the umbilicus is contained within it, And the lower middle region is that immediately above the pubis, is

called the Hypogastric, from being the lowest and oppos-ite to the epigastric, Within this region there is also a sub-division which would be circumscribed by setting one leg of a pair of dividers upon the symphyses of the pubis and describing a semicircle of two inches radius, This is called the Regio Pubis and in it are performed some important surgical operations, as tapping the bladder and what is called the high operation for stone, in which the distended bladder is cut down when in this region and the stone extracted through the opening. These then compose the three middle regions and their subdivisions, - the lateral are named first, that opposite the epigastric, from being beneath the cartilaginous border of the ribs is called Hypochondriac, - The middle lateral being ~~in front~~ on a level with of the lumbar vertebra is called Lumbar region, - and the third or lowest covering in the centre of the ilium, is called the iliac region, the prefix of right and left being applied to designate the correspond-ing sides, as right hypochondriac, right lumbar, right iliac &c., This makes up the entire nine divisions each of which contain different viscera or different parts of the same one, The right hypochondriac region contains principally the right lobe of the liver, the contents varying however somewhat according to the position of the individual, In the horizontal position when the weight of the large organ does not draw it down, it retreats so that if in a healthy condition it cannot be felt by the fingers pushed under the margins of the ribs, In the vertical position however, it descends nearly upon a level with the margin, and may be felt, particularly in thin individuals, A knowledge of this fact is of great importance in practice as it will enable you to judge of the condition by the size of the organ, for in some instances it becomes so enlarged as to occupy the right lumbar region in addition to the hypochondriac, Of the normal size however one would not expect to be able to feel it whilst the patient was in an horizontal position, The gall bladder also deserves to be noticed in this region, as it frequently becomes distended with bile and projects so as to be felt below the margins of the ribs particularly in lean subjects, The position of this just below and near the end of the ninth rib, deserves to be particularly noticed

as by presenting a fluctuating point here it has been mis-taken for a tumour or abscess, and actually punctured. It sometimes too becomes the subject of inflammation and forms adhesions to the peritoneum covering the walls of the abdomen at this point, where ulceration through has taken place and established distressing billiary fistula, from which the secretions of the organ have been constantly poured.
The liver does not only occupy this right hypochondrium, but extends across the upper part of the Epigastric region through the scrobiculus cordis, and occupies by its left and smaller lobe the upper and back portion of the left hypochondrium. Here it never under any circumstances of enlargement comes down so low as to be felt beneath the ribs, as it is much smaller upon this side than the other. Its existence can however always be detected here by the dullness which it renders on percussion, in contrast with the resonant lung above and the inflated stomach below. More deeply seated than the liver in this left hypochondrium, and behind the left portion of the stomach, we have placed the Spleen, - that organ of all the most liable to variation in size and position. It is here of about the normal size being about 4½ inches long by 3 wide - from which it varies often, or during some diseases to the extent of filling the lumbar region below, and even in some cases reported, extending across into the iliac region of the opposite side. This is the organ which when enlarged so as to produce a tumour below the ribs as it often does in intermittent fevers is called by the common people the ague cake. It receives in animals the name of "Melt" also by the common people. Between the liver and the Spleen in this region there exists a space which is filled by the left portion of the stomach, - this is called the Splenic or greater extremity of the stomach, and is that portion which receives the termination of the oesophagus or gullet through which the alimentary matter is introduced into it. In the Epigastric region is found the remaining portion of the stomach, and as before mentioned a portion of the liver as it crosses over in contact with the diaphragm; behind the stomach here, we have the part of the pancreas and duodenum which lie upon the dividing line between this and the umbilical region. In the umbilical region we have first a portion of the colon or large intestine called the transverse portion, crossing the upper part of it, below a portion of the small intestine, and behind, a part of

the pancreas and duodenum. In the hypogastrium we have the great mass of the small intestine and the bla-dder; and in the female the Uterus, which becoming gra-vid rises up into the umbilical region displacing the the other viscera, sometimes leaving the intestines before and sometimes behind it, but nearly always behind it. On the contrary when not enlarged nor the bladder distended, the intestines sometimes sink do-wn and a portion of them occupy the pelvis. These organs are seldom all at once distended with air or alimentary matter so that their position is very liable to variation from this cause; for instance if the stomach be distended with gas the colon not being so, the latter will be pushed down and a tympanitic sound rendered on percussion, on the other hand if the colon be distended as it is in flatulent colic, and the stomach be empty or nearly so, then the colon will rise up and take its place, and yield the same tympanitic sound, so that we cannot tell in ordinary cases, simply by percussion whether the parts are in one or the other of these conditions. If however in the painful affections referred to this part, we have a rumb-ling noise followed speedily by an evacuation from the bowels, we may easily refer the affection to the colon and know that the cause is simple flatus. Thus we see that this upper region may be occupied by each of them in its turn according to circumstances. In the right iliac region we have situated the Cœcum or Caput Coli filling nearly the whole space this colon which thus commences here ascends upon this side and with the kidney of this side fills the lumbar region, this portion of the large intestine is called the ascending, it turns across in the upper portion crosses the umbilical portion as the transverse colon and descends upon the left side through the lumbar region which here also contains the kidney lying behind it. Passing on down, this decending colon makes what is called its sigmoid flexure partly in the lumbar and partly in the left iliac region, where it terminates in the rectum or straight portion, the end of which is the anus. Thus we see that these parts being very variable in position and hence must be very movable, occupying different positions with every step we take and every breath we draw. These portions are known to be very sensitive but not by an ordinary sensibility, for they may be

lacerated or cut away by scissors without eliciting any degree of pain. The sensibility is then of an organic character, and is exhibited in the speedy and often very fatal inflammations which follow injuries of these delicate tissues. The nerves which supply them being rather those of organic than those of animal life. If then these tissues are so liable from slight causes to take on diseased action, and if they are continually in motion with the motions of the body we might readily suppose that the friction or attrition to which they are thus subjected would produce bad consequences. To prevent this however there is an admirable arrangement by which each viscus is lined or coated by a thin delicate membrane called the Peritoneum, which is exceedingly smooth and polished, and secretes a thin fluid by which the whole surface is lubricated, in the same manner that the joints are furnished, the two membranes being perfectly analogous. This coating is divided into two portions, one covering the viscera and called visceral, the other covering the walls and called parietal. This membrane although so very smooth and shiny upon its inner face is attached by the other by loose cellular tissue to the surrounding parts, as we have seen for instance upon the fascia transversalis, and although so thin as to be quite diaphanous, is at the same time so vascular that when its vessels are perfectly injected it looks like a red sheet of tissue, and so well furnished with absorbent vessels too, that when these are perfectly injected with mercury the membrane has the appearance of a sheet of silver. In fact it appears to be only a condensation of cellular tissue in such a form as to make a membranous expansion. If we can conceive of cellular tissue, which may be represented by this piece of sponge, becoming flattened and condensed upon its surface so that the cells of which it is composed are collapsed and flattened to form a crust as it were we shall then have a pretty good idea of the structure of the Peritoneum, for when it becomes inflamed this condensed portion seems to be expanded out into ordinary cellular tissue from the expansion of the flattened cells, there being nothing to be seen then but ordinary cellular tissue. This peritoneum exists in man as a perfect sack, and has been dissected out and demonstrated as such. In women however, the sack is not perfect on account of

the opening of the fallopian tubes by their fimbriated extrem-ity, This opening it is said, has admitted the entrance of acrid substances which were injected into the uterus for diseases of that organ, - into the cavity of the peritoneum and produced fatal consequences, This however could hardly occur under ordinary circumstances as the tubes are so small as scarcely to admit of such injection,
This membranous sack is of immense size, and has all the viscera pushed into it as it were, from behind, with-out making any opening in it, - For instance let this Cloth represent the sack and this sponge the liver, which is thus pushed in and enclosed, being attached behind by the folds which surround it coming together, Now if we can thus insert one organ there is nothing to prevent our inserting a dozen, and so it is that all are inserted, This membrane the which forms the hardest part of anatomy for the student to comprehend, we shall now take up the consideration of and endeavour to explain; The attachments formed by its reflections off from the parietes to cover the various viscera ~~form~~ form the part of ligaments whereby the viscera are held in position and are sometimes though not in all situations called lig-aments, We first have it reflected upon the abdom-inal muscles up upon the diaphragm from which it is reflected off in two layers as it were, one going upon one side the other upon the other, thus forming the two lateral ligaments of the liver, That these are mere folds of peritoneum and not absolute ligaments is app-arent from the transparency of them even when double Besides these lateral ligaments of the liver, we have a suspensory or falciform ligament formed also of folds of peritoneum connected with the linea alba, these being required to support the great weight of this viscus, upon the lower margin of this ligament and running from the Umbilicus we have a rounded cord like portion which is sometimes described separately as the ligamentum teres This is the remains of the umbilical cord of the foetus which is now become hard and solid serving to sustain the liver, from the shape of the process of peritoneum forming this ligament, the round ligament on the convex side, the whole has been called falciform the round ligament forming the back of the sickle ~~scythe~~. This ligament runs

vertical upon the diaphragm above, and descends in two layers to the transverse fissure which separates the two lobes of the liver, after reaching which one layer is spread over one side or lobe and the other over the other, thus giving to the organ a coat of peritoneum which however is spread over its proper fibrous coat. As this layer passes down it gives a partial covering to the gall bladder and then reaches the inferior margin of the liver where it is continuous with those which we first noticed as being the lateral ligaments. Here we have the two layers together after having completely covered in the liver, and these two layers we will start with. From the lower margin of the liver they proceed across to the lesser curvature of the stomach, and as they thus cross they enclose between them the billiary ducts, arteries and veins with the hepatic plexus of nerves, these being held together by some cellular tissue form what is called the Capsule of Glisson, from that anatomist having described this cellular tissue as having the office of forcing the bile out of the liver into the intestine, this we now know however to be fallacious. These two layers passing from the liver to the stomach form the gastro hepatic or lesser omentum upon the right side, and as they pass off to the left to give a covering to the spleen are called the gastro splenic omentum, for all these reflections of the different portions which contain fat are called omenta or epiploa. When reaching the lesser curvature or upper edge of the stomach the two layers separate and receive that viscus between their folds giving to it a covering upon both surfaces. After thus investing this viscus they again come together at its lower border or curvature, and are continued down together to form the great apron like covering which is here found tucked up around the stomach, but which is generally found extending down over the small intestines to the lower part of the abdomen. This is the great omentum or caul, and is larger upon the left than on the right side and hence is more liable to get into a hernial sack. This membranous caul always contains more or less fatty matter and is often very full of it in persons prone to obesity. After proceeding down together to their lowest point these two layers are turned back upon themselves, and again ascend, thus making this omentum although so thin as to be diaphanous, consist of four layers of peritoneum. As it goes back or upwards

they receive between them the colon and give it a coating on either side, and here after uniting from the colon they take another name being no longer omentum, but mesoco-lon, after proceeding thus for a short distance inward, they divide for the last time, one layer going down towards the pelvis to form the mesentery by which the small intestines are attached to the spine, and the other layer going up to gain the ~~liver~~ diaphragm again above the liver. As they separate from each other to go in different directions they must of course form a triangle and in this triangle between the layers are seated the viscera spoken of particularly by the germans as the ex-tra peritoneal viscera, from the fact that they get no coating. These consist of the kidney duodenum, and part of the pancreas, We notice that the pyloric orifice of the stomach terminates in the duodenum which after passing up towards the gall bladder turns downwards and is immediately lost from view, this is because it then gets behind the mesocol-on and becomes extra peritoneal as it were, after which it makes another turn and crosses the spine, when if we turn up the colon we find it again enveloped in periton-eum, In the elbow thus formed the head of the pancreas is lodged being adherent to it throughout. If we now raise the liver we find the mesocolon going up to where we star-ted from in our description, If these layers have been fully and properly traced out, they ought to form a sack by thus being doubled upon themselves, This is sometimes obliterated in old subjects by the effusions of lymph consequent upon inflammation, but in children is always found open, It sometimes becomes the seat of dropsical effusions which escape into the common cavity of the abdomen through what has been called the foramen of Winslow, this is reached by passing the fingers under that part of the gastro hepatic omentum forming the cap-sule of glisson, - and then downwards into the opening or foramen, By dividing with the scissors the two anterior layers where they leave the stomach, you see I open at once into this sack and can pass my fingers through into the common cavity by this for-amen of Winslow, The portion of the mesocolon which descends being continuous with the portion enveloping the small intestine, decends afterwards to line the ~~rectum~~ pelvis and the viscera contained within it,

**Lect. XLIII.** I shall endeavour by a diagram, this morning gentlemen, to recapitulate what I yesterday said upon the peritoneum and, thereby make clearer some points either passed over hastily or omitted in that demonstration, and prove to you that the whole of the viscera contained within the abdomen may be covered by peritoneum in one continuous sheet, taking any starting point and getting back to it after having enveloped the whole of the organs which receive such a coating, The diagram must represent a vertical section of the cavity directly through the middle line, seen from a lateral position, in which all the viscera are supposed to be divided through, Now if we can start from any given point and covering in all these, get back to the point from which we started it must be evident that this is a true sack into which as I have endeavoured to demonstrate, the viscera are pushed from behind without in any degree breaking its walls,

Now having thus made intelligable to you as I hope the whole of the intricacies of this membrane, and shewn you its reflections upon the pelvic viscera where it is sometimes necessary to perform operations in which it must be avoided with great care, I may mention incidentally that the sack of the great omentum, has sometimes become the subject of inflammation in cases where the foramen of Winslow has been closed by lymphous adhesions, - it has been subjected to effusions of water giving rise to swelling of this particular part without the rest. - This sack has also been found under some circumstances filled by pus where the inflammation was of a more acute character and went on to suppuration, After having thus endeavoured to exhibit these reflections of peritoneum in the most lucid manner, I shall now go on to speak of the great and important muscle which forms the upper boundary of this cavity of the abdomen, I mean the

## Diaphragm

This is divided into several portions. from arising from different points, and being separated by tendinous substance thus we have the greater and lesser muscles of the diaphragm and the cordiform tendon, and hence a roots By dividing the spinal column and throwing the upper part of the subject back, you are all enabled

to see this great muscle in its relaxed condition as forming the septum, between the abdomen and thorax And the first thing which strikes us is the White tendinous Centre portion shining in the midst, This is as may be seen somewhat of the shape of the heart figure upon a playing Card, the apex or point of which is towards the sternum whilst the notch receives the Spinal Column as it descends, This tendon receives into its margin all the muscular parts which go the constitution of the muscle, and is attached upon its upper surface to the pericardium surrounding the heart, This connection is almost inseparable, forming the floor as it were, of the Cavity which holds the heart, From this it will be seen that this middle portion must be immovable in the contractions of the muscle otherwise we should have the heart descending at any breath, and altering its place of pulsation against the Parietes of the Chest. This cordiform tendon is upon a level generally with the second bone of the sternum Whilst the muscle rises during expiration or when the muscle is in the relaxed position in which we have it here, up as high as the anterior extremity of the fourth rib And a Considerable distance higher upon the right than on the left side, in Consequence of the solid apex of the heart not admitting it to the same extent here, whilst upon the right the lung is yielding and compressible, This extension upwards in the relaxed condition is very different from the position occupied in the contracted condition when it occupies the line in which you see the [illegible] placed, being the Cord of the arch which it now describes, or a direct line from the attachment of one point to that of another, This arrangement as you may notice is calculated to enlarge to a very great extent the vertical diameter of the thorax, by the effacing of the arched form which before existed, at the same time that the transverse diameters are enlarged by the muscles which we have already studied upon the outside of the thorax, This great muscle as before mentioned, is divided into two parts called the greater and lesser muscles of the diaphragm, That called the greater takes its origin first from the ensiform Cartilage of the sternum upon

its inner face, and also from the inner face of the margin of the ribs all around. Converging ~~thence~~ like radii the muscular fibres are inserted into the Cordiform tendon some of them interlacing with each other, between the part which comes from the ensiform Cartilage and that from the adjoining Cartilage of the seventh rib there exists a space filled up only by very thin Cellular tissue & a globule of fat. This presents a weak point, and sometimes through it take place hernias of the stomach colon or liver into the Cavity of the thorax, some instances of which I have seen principally in Children. Some surgeons Larrey noticing this space here and the facility with which it may be come at, have proposed to tap the ~~diaphragm~~ pericardium at this point by separating the muscle without wounding it, and in this manner get into the pericardium so as to discharge any fluid which may have been effused there. This seems like a plausible operation, but so far as I know has never yet been performed upon the living subject perhaps because the diseases giving rise to such effusions are generally of an organic nature and would not therefore be benefited materially by an operation at least the temporary benefit promised, has not seemed to warrant the incurred risk. The lesser muscle of the diaphragm or that part in relation to the Spinal Column and back part of the abdomen gets its origin from the second third and fourth lumbar vertebrae generally by four heads on the right side and three on the left. Those two long ones which extend down lowest are called sometimes the pillars or Crura of the diaphragm, the one upon the left does not generally descend so low as that upon the right, and either or both of these lower slips are often deficient. Their fibres are continued on up from a white ligamentous line seen crossing over from within to without of a bow shape with the convexity up or for- ~~downwards~~, there exist two of these ligamentous bands on each side, one is called ligamentum arcuatum internum, the other which is smaller, is the externum. After ascending the fibres from the two sides decussate and by this decussation give passage to the aorta beneath the decussation and the oesophagus or gullet above the decussation taking place between these two apertures in the notch of the Cordiform tendon before the

lesser muscle is inserted into this tendon. The aorta which is thus first accommodated lies immediately in front of the Spine, and from this fact, and its resisting nature is not liable to serious compression from the contraction of the muscular fibres, whilst the oesophagus alone is a kind of slit in the muscle through which the tube passes, being dilatable, but not continuing dilated into a round opening. A little to the right and somewhat anterior to the last, is another opening of a quadrilateral shape. This is occupied by the ascending Cava, which being a thin tube, devoid of any muscularity, or any persistent shape except that given by the distension of the blood which fills it, was necessary to be protected from all constriction, which would be produced by muscular fibres. This opening was then made not among the muscular fibres but through the fixed Cordiform tendon, the fibres of which are so arranged in circles around it as to prevent any thing like compression in the action of the muscle, which would result in a congestion of the whole lower part of the body and limbs, with its consequences. This hole then is just like a hole cut out of a board for the passage of a tube through it and offers no more obstruction than that would. These two the greater and lesser muscles of the diaphragm are united as may be seen at each side by the intervention of the Ligamentum arcuatum before spoken of, from which come of fibres uniting the two together so that no definite natural division can be made between the two. This diaphragm is concerned in respiration by increasing the vertical capacity of the Chest, – in defecation and micturition by compressing the viscera of the abdomen in concert with the abdominal muscles, – in phonation by the modification which its action produces in the quantity of air passing through the larynx, – in vomiting to a degree by the pressure which it exerts upon the stomach below, – and by its spasmodic contractions produces hiccough. These drawings which I have of the muscle, the size of life, represent the different views of it more clearly than upon the subject where it could not be retained in its place in the dissections represented here. You have in them

first a front representation with the anterior parietes of the chest and abdomen removed, - second, a view of the muscle and cordiform tendon from above, with the openings in it, - and thirdly a back view in which the vertebra and posterior parts of the ribs have been removed, and fourthly a view from below. in which the Crura and passages for the vessels are displayed, In all these you will notice that it rises higher upon the right than upon the left side, by which more space is allowed to that lung. These Ligamenta Arcuata which we have heretofore noticed, you see are placed here, binding down the muscles which get their origin from the thorax above this point, - the internum covering that part of the psoas magnus, and the externum, the Quadratus ~~iliacus internus~~, which come down at this point, - so as effectually to prevent the intrusion of any of the abdominal viscera under any circumstances to find their way into the thorax by this route, in as much as the ligaments come from the spine and span the muscles outward binding them close down against the back part of the thorax or ribs, We next come to notice some other muscles which with the viscera are seated upon the internal part of the abdomen. The first of these is a small one which is very often absent and is called the

## Psoas Parvus.

This muscle arises fleshy from the sides of the two upper lumbar vertebra, and often from the last dorsal, from whence we trace it down by the side of the spine soon terminating in a long slender tendon by which it is inserted into the iliac fascia near the commencement of the sheath of the vessels which run out under poupart's ligament, - and also into the linea ileo pectinea near the anterior third of its semicircumference, Its action will be that of aiding the other muscles within the pelvis in bringing the spine over the pelvis or the pelvis up upon the spine, Its action will also be felt upon the sheath of the vessels, acting as a tensor to draw them up into the pelvis by pulling upon the fascia The next muscle which presents itself is the

## Psoas Magnus.

A much larger and more important one than the last, and lying like it upon the side of the spinal col

-unii, This muscle takes its origin from the sides of the bodies, and also from the transverse processes of all the lumbar and the last dorsal vertebra, arising out at its upper part from under the ligamentum arcuat-um internum; thus forming a broad strong muscle we trace it down under the ligament of Poupart where it joins with the iliacus internus and is inserted into the lesser trochanter of the thigh bone. This is a very delicate muscle being covered only by a thin sheath and having the cellular tissue in its structure, it forms the "tender loin" in animals and is much esteemed as a delicacy, - Its action is to flex the thigh upon the body or the body upon the thigh, At the edge of this muscle we notice a channel in which runs the crur-al nerve, and down which the pus makes its way in psoas abscess, to point in the groin, The next muscle to be noticed is that known as the

## Iliacus Internus

This muscle arises from the transverse process of the last lumbar vertebra, from the inner side of the crest of the ili-um for its whole length and from the space between the superior and inferior spinous processes, - from the whole venter of the ilium and in this case from a part of the capsule of the hip joint, From this extensive origin it is collected into a large muscle passes under Poupart's ligament upon the outside of the Psoas magnus, and is inserted with it into the lesser trochanter upon the inside of the thigh bone. The action of this muscle is similar to that of the Psoas only that it does not extend to the spine, We next come to the

## Quadratus Lumborum

A small square muscle enclosed between two layers of the transversalis fascia, as you may see, and beneath the psoas. It arises from the crest of the ilium posteri-orly, and is inserted into the transverse processes of all the lumbar vertebra, and into the last rib, It has a quadrangular shape as its name imports, and has its upper portion covered by the ligamentum arc-tuatum externum, Its action must be that of bending the spinal column in the region of the loins, laterally and also of fixing the lower ribs by joining them to the crest of the ilium below,

**Lect. XLIV.** Having shown you the walls of the abdomen and the manner in which Inguinal Hernia is formed in connexion with these, and also the structures contained within the abdominal cavity both muscular and visceral, I have now to speak upon a subject, cousin German to both these namely the occurrence of femoral or crural Hernia in connexion with the parts concerned in its production. There is perhaps no part of the studies of a Student which he considers more difficult, and approaches with more dread, than this study of femoral hernia, yet if you will give me your close attention I think that in to days lecture I shall be able to make you understand it clearly. Before entering upon the study of the fasciæ concerned in this form of protrusion we must look at the bones and muscles which have relation with the parts. We first notice in the anterior part of the bony pelvis a concavity or hollowing out of the bony walls between the superior spinous process and the symphyses of the pubis. Across this concave surface we have before noticed the formation of Pouparts ligament by the tendon of the external oblique muscle, which subtends the whole notch. From the lower part of Pouparts ligament near to the pubis we notice a triangular portion of the ligament which has a different insertion from the common ligament, running backwards upon the ~~crest~~ the pecten from the spine of the pubis whilst the proper ligament of Poupart is inserted on the spine of the bone. This portion has had a particular name given to it, being called Gimbernats ligament, after a celebrated Spanish Anatomist, who first described its relations to the peculiar kind of hernia now under consideration. This does not run down vertically from Pouparts ligament, neither horizontally, but obliquely backwards and inwards to the before named ~~crest~~ ridge of the ~~ilium~~ pubis which marks the upper boundary of the true pelvis, which is the commencement of the ileo pectineal line. The size of this portion of the ligament is very various being generally about half to three quarters of an inch wide at the base, being rarely developed to the extent to which you see it upon this side of this dry pelvis, when it is two inches in breadth. Sometimes on the contrary, as I have often found in operating for this form of hernia, it is found very small. This difference in size must exercise a great influence over the occurrence of protrusions, as when it is as extensive as in the dried specimen it must present an insurmountable barrier to their occurrence. It is true that cases

or pecten

have been noted when the protrusion has taken place through a breach in this ligament, such as has accidentally occurred in this one, but such instances are extremely rare, there only being two or three well made out, upon record. The distinctive difference in the protrusion between inguinal and femoral hernia is that the first occurs through the abdominal ring above Pouparts ligament, whilst the latter takes place through the femoral ring below Pouparts ligament, before going on to the particular anatomy of this opening we must examine what it is that is contained in the space between Pouparts ligament and the bone. We yesterday noticed two muscles, namely the psoas magnus and iliacus internus, coming from the lumbar vertebra and the venter and crista of the ilium, and going down beneath Pouparts ligament to be inserted into the lesser trochanter and a portion of the bone below it. These muscles pass under the ligament in contact with each other and are inseparable, filling up the outer two thirds of this space. In the notch between them passes out the anterior crural nerve to its distribution. Where they pass under the tendon or ligament it is firmly bound down upon them by cellular tissue and the great fascia of the thigh so that there is no possibility of any protrusion in the whole of this space, and thus two thirds of the whole space is disposed of securely. The inner border of the psoas magnus, which is the innermost of the two, runs sloping down covered by its thin fascia, to the bone where we find lined by a fascia which can be traced upwards and downwards to the surrounding parts. In the space between the outer edge of Gimbernats ligament and the symphyses of the pubis, there is neither any space to be found through which it is possible for a protrusion to occur, except the external ring above. Between the outer edge of this ligament and the edge of the psoas magnus muscle, however there is a considerable space, which if not occupied would permit large protrusions, but which if perfectly occupied, would effectually preclude the very existence of femoral hernia. This space is occupied by the iliac artery, iliac vein and the cellular tissue forming their sheath, with some other matters to be noticed hereafter. The iliac artery which comes out to become femoral upon the thigh, lies upon the outer side and in contact with the sloping edge of the psoas muscle before noticed, and

immediately upon its inner side lies the iliac vein which as we may see is not sufficiently large to fill the whole of the space remaining between the artery and Gimbernats ligament. Now this large vein, unlike the artery, has not strong and resisting coats by which to ward off external pressure and moreover is placed where the space between the ligament and the bone is narrower, Being thus liable to external pressure the flow of the blood along it would have been impeded if it had been confined laterally, and thus given rise to seri-us congestions of the lower extremities and all their unplea-sant consequences; hence as it is placed subject to be compressed in one of its diameters, there was a necessity for space by which it might correspondingly enlarge the opp-osite one, and therefore not alter the effective capacity of the vessel, For this purpose a certain space was provided within the sheath of the vessels, and between the vein and Gimbernats ligament, which being of a rounded shape constitutes the super femoral ring through which the intestine or omentum protrudes in the variety known as fem-oral hernia, With this sketch and exhibition of the surr-ounding parts upon the dissected side of the of the subject, we may now proceed to the elaborate nature of the affection and the seats of strangulation to which it is subject, - upon the side where the parts remain in a natural condition, First beneath the integument we here come to the superfic-ial fascia which we have seen existing all over the body, This we have found in some places to be double, and here in the groin we meet with another example of this bifoli-ato fascia as in the neck, The splitting in this region is for the purpose of giving lodgment to the superficial lymp-hatic glands, so called because there is another set sea-ted below the fascia lata of the thigh from which it is ne-cessary to distinguish them, These are all occasionally involved in syphilis and their enlargement here consti-tutes bubo, They are not however liable to quite the same extent and those the more deeply seated of course give rise to the more serious affections, They are spre-ad out for some way down upon the thigh and upwards as high as Pouparts ligament, indeed when enlarged they sometimes appear above it, The are developed on the absorbents or lymphatic vessels of the leg and genital organs, in the same way that those in the arm pit are

Sympathetic
Specific Bubo

and subserve the same purposes. The superficial fascia although closely adherent to pouparts ligament, may still be demonstrated as continuous with that of the abdomen and leg. When this is raised and turned up upon the abdomen we notice below it a strong dense membranous aponeurosis covering the muscles of the thigh like a stocking and binding them down to their places. This is the fascia lata femoris as it has been called, and as you see exists as an entire sheet, surrounding the whole limb until it gets upon the upper and inner anterior part of the thigh where the saphena magna internum vein coming up upon its outside from the foot and leg, goes to empty itself into the femoral vein just before it passes under pouparts ligament to become iliac, Now to allow to this saphena vein a free inlet into the femoral in such a manner as not to be incommoded in the very various and free motions of the part, it was necessary that this fascia lata should divide into two portions which should separate from each other. This division as you see takes place about two inches below pouparts ligament, and the two portions are named according to the muscles which they immediately cover, - that upon the inside proceeding up upon the adductors and pectineus muscle is called the pectineal portion, and the outer or that ascending upon the sartorius, is called the sartorial portion of the fascia lata, their point of separation is denoted by a crescentic edge presenting a concavity upwards, - over which the saphena vein passes, These portions of fascia ascend to have firm connexions above with pouparts ligament and the symphyses of the pubis, - which ligament having the tendons of the abdominal muscles above, and this fascia lata below is thus kept tense, and bound down upon the parts below. The upper edge of the sartorial portion ascends and is inserted into pouparts ligament until it arrives at the point where gimbernats ligament commences and is then inserted into this for the whole of its length by a process which is sent inwards from this sartorial fascia, which thus forms another crescentic or falciform edge above, until it entirely spans the vessels as they come out under pouparts ligament, and reaches the pubic bone at the same point with gimbernats ligament,

The pectineal portion of the fascia follows up the muscle until it reaches its place of insertion upon the pubic bone where it becomes again perfectly continuous with the sart-orial portion at its termination near Gimbernats ligament. Thus forming a perfect oval opening being continuous above with Pouparts and Gimbernats ligaments and below with the fascia common to the thigh. The edge of the opening above is called Heys or the femoral or falciform ligament and is very comm-only the seat of stricture in femoral hernia. In all parts of the body we have seen the great vessels surrounded by a particular sheath, and find no exception to that rule here and as the vessels have no sheath proper while in the pelvis, we have next to enquire how they get one and where from. That sheath we notice upon the other side of the subject, of a funnel shape at the upper end and entirely distinct from the ligaments which have been rem-oved. This funnel form of it gives it a peculiarity which as we shall see much interests us. Now if we examine again for a moment this transverse fascia which we have already had occasion to notice, we find that it goes down to be inserted upon the outer two thirds of Pouparts ligament firmly and by its intervention of course to the fascia. This attachment we then find to be along the edge of Gimbern-ats ligament down to the pubic bone and thence along the edge of the crest to the linea alba. Now this fascia we have dissected fully out and free down to its margin at the ligament, and if we push a knife handle as you see I do through under Pouparts ligament but anter-ior to the fascia, it comes out, below in front of the sh-eath of the vessels, whilst if I pass it down inside of the transversalis fascia you see it comes through below inside the sheath of the vessels, thus exhibiting at once and distinctly to the view of every one, that the transversalis fascia and the anterior portion of the membranous sh-eath of the vessels are perfectly continuous, and then we have one part of this sheath formed. This is rendered still more clear when you see that by pulling upon this transverse fascia above I draw upon the sheath of the vessels below. Now we next notice that over the Iliacus and Psoas muscles is stretched a layer of fascia called the iliacus fascia, which extends to the edge of these muscles and then going over dips

down into the true pelvis and covers in all the muscles and viscera at the bottom of this cavity becoming then the pelvic fascia, Now as this descends down upon the iliacus and psoas muscles as they pass under pouparts ligament, it comes to be inserted into this ligament for the whole extent of the muscles, When it arrives at the inner edge of the psoas muscle it still continues to cover it closely and therefore leaves pouparts ligament, to slope down to the bone with the muscle, immediately upon the outside and connected to the great iliac artery, upon getting down to the bone it becomes attached to it along the ileo pectineal line to the insertion of gimbernats ligament where it is identified with the transversalis fascia which we traced down to this point, In this course the fascia must of course go behind the vessels, Now if we raise this iliacus and pelvic fascia at this point and pass a knife handle out behind it, we find it below on the outside of the sheath of the vessels, whilst if we pass it before this fascia it will go into the sheath We must now see clearly how the sheath is formed The iliac and transverse fascias being inserted together upon the outer two thirds of pouparts ligament, separate on arriving at the edge of the muscles or at the vessels the one going before the other behind them, and then coming together again to be continuous at the base of gimbernats ligament, Now if we conceive these fascias to be extended down where they surround the vessels we have a proper idea of their sheath. And as this space between the psoas muscle and the margin of gimbernats ligament is larger than the sheath is down the thigh we must see the funnel shape of this portion, and see that it is too large to contain the vessels simply, The artery being firmly fixed upon the outside of the sheath and the vein being attached to the artery, the space forming the proper crural ring through which protrusions take place is apparent, and it is also apparent that this protrusion can only take place into the sheath of the vessels on the inner side of the vein for the accommodation of which the opening was designed, After getting into this funnel shaped sheath we may see that the intestine cannot pass down it lower

them the crescentic edge below where the sheath becomes so narrow as only to contain the vessels with one or two small nerves. It must therefore take some other course as we shall see. This crural ring or opening is always found occupied by a thin layer of cellular tissue called the crural septum and also lodging one or two small lymphatic glands which sometimes becoming enlarged in syphilis completely occlude the opening and prevent the possibility of protrusion the only use by the the way, to which one can put the affection. This thin fascia or septum, has been called by Sir Astley Cooper, the fascia propria, as it forms the immediate covering to the sack by being pushed out before it.
We may here notice that the fascias unite outside of the artery fastening it close to the muscles, and that between the artery and the vein there exists a vertical septum completely separating them from each other. The whole of these parts surrounding are of course lined by peritoneum which being pushed before the intestine forms as before the proper sack. This peritoneum very often contains at this part deposits of fatty matter which it carries down with it in the gradual dilatation which the intestine makes. These protrusions are sometimes quite small presenting a little tumour in the groin about the size of a hickory nut. If the protrusion proceeds on down the sheath it cannot get far in that direction but generally changes its course getting through some opening in the sheath of the vessels, usually that by which the saphena vein enters,- this it dilates making what is called the accidental crural ring, passing through which it sometimes has ascended upwards (the course generally taken) in some cases upon which I have operated, as high as the anterior superior spinous process. The coverings to the intestine in this form of hernia are first the skin, then the superficial fascia, next the fascia propria, and then the peritoneal sack, exclusive of the sheath of the vessels, which covers it in a part of its course, all of which it is necessary to open in this form of hernia. We next have to examine into the possible and most common causes and seats of stricture in this form. First the intestine may be strictured at the accidental crural ring in which case the sheath must be divided cumbettes upwards

and inwards in the course of the vessels, A second and more common seat of stricture however is the edge called Heys ligament, and thirdly but more rarely Gimbernats ligament may be found to be the seat of a stricture, ~~but as~~ Heys is the more prominent, this point cannot always be distinguished, - The most common of all the seats however is the neck of the sack which is the narrowed part of the opening where the peritoneum is plaited up in folds and adherent to the sides. The operation for this form of hernia is to cut through the skin and fascia, open the sheath of the vessels if necessary and then as directed in most of the works pass up the little or fore finger along the intestine and upon it the probe pointed bistoury, but this direction of the books is perfectly ridiculous, as it is often very difficult to pass up even the smallest direc-tor, I should then rather direct, as I always prefer, to pass up a smooth knife handle or spatula and then introducing the probe pointed bistoury flat upon it divide the outer part of the stricture so as to enable you to get your finger in without pressing too hard upon the already compressed intestine, When the finger is passed up and nothing found in the way then the knife is passed in flat upon the finger and the stricture divided upward and inward, The position of the artery here deserves great attention, we have seen the usual straight course of the epigastric, - but in about one case out of six it either winds directly over this opening to become the obturator, or else the obturator comes off from this just above the opening and thus partly surrounds it, and is liable to be cut, and cause the patients death, as they are generally in a precarious situation before the operation is called for. In a case to which I was called by my friend Dr Franklin of this city I found when I introduced my finger that the artery was pulsating nearly all around it, I took the handle of a forcep which is something like a file and ~~rasp~~ it across the edge of the bistoury so as to dull it knowing that the resisting band would be cut by it though dull, whilst the artery being loose would give way before it, and remain uncut, the plan succeeded perfectly and the patient recovered, The intestine is to be examined carefully to see that not gangrenous, and then very carefully replaced

Lect. XLV.

I propose to day gentlemen, in the regular pursuance of our Studies, to call your attention to another very important and somewhat intricate part of the anatomy of the trunk -important from its relations to daily practice in the ordinary duties of a physician, and important also from its surgical relation to various operations and most common affections, I allude to the perineum, the superficial anatomy of which we shall be principally engaged in to day, This term perineum is a somewhat ambiguous one in as much as it is frequently perverted from its first and correct meaning, being too commonly applied to the integuments which are formed in the fissure between the buttocks, being in this sense extremely superficial, But the true acceptation of the term perineum, should be, and is surgically applied to the whole space below the pelvic viscera and between them & the integuments (between) the bony and ligamentous boundaries to the lower outlet of the pelvis, This opening or outlet is as you see, of a lozenge shape, its boundary consisting of four sides and four angles the anterior angle is the symphyses of the pubes and the two anterior sides the decending ramii of the pubes and ascending ramii of the ischium, The two lateral angles are formed at the tuberosities of the ischii and the two posterior sides are formed by the sacro sciatic ligaments as they cross to form the posterior angle at the point of the os coccygis. This we may notice from the lozenge shaped space before spoken of as constituting the proper perineum, This is for practical purposes and for description ones too, - divided into two regions the anterior or perineal region, proper and the posterior or anal region, these are both spaces of a triangular shape, and nearly equilateral, being formed by a dividing line drawn across between the two tuberosities of the ischium, It is with the anterior of these triangular spaces that we are at present concerned, which instead of being limited to the superficial integument we shall find to be three inches deep or thick at the anterior face of the rectum, and at least one inch in thickness at the symphyses of the pubis including all the parts lying between the pelvic fascia above and the skin below, these approaching nearer at the pubes than at any other point, The skin which we raise from the perineum, we find to be perforated for

extremity of the rectum, where we find it continuous with the mucous membrane which lines the bowel, there being a gradual change in the character of the tissue. As the integument approaches the orifice we find it becoming thin-ner, and losing its fleshy colour and becoming dark, and becoming insensibly changed into the nature of a mucous lining exchanging the ordinary cuticle for a thinner and more delicate one consisting of different sorts of scales and called epith-elium which is always found upon mucous membranes. This orifice by which the faecal contents of the bowels are discharged constitutes the anus or orifice of the rectum. When this skin is raised we perceive that it is somewhat thicker than upon the ordinary portions of the body, and is moreover very ~~ductile~~ yielding, which was necessary in order to the dilatations to which the parts are exposed. We trace it upward over the scrotum and parts surrounding to be continuous with the common integument. We next come to the superficial fascia immediately beneath it, which we find passing off over the adductor muscles of the thigh and the glutei of the pelvis, in common with the same membrane found upon other parts of the body. This is therefore the ordinary superficial fascia and has nothing to do with the special anatomy of the part except that it makes one of the external coverings, being entire-ly separate and distinct from the proper inferior fascia of the perineum, which is sometimes described as the superficial fascia of the perineum, although er-roneously as it is very liable to create confusion by the similarity of the terms. It therefore should never be spoken of as belonging to the perineum more than to other parts of the body. As this common superficial fascia passes upwards upon the scrotum it loses its proper character of fascia, and becomes trans-formed into a contractile tissue of a fibrous character forming two parts which meet upon the middle line or raphe. This constitutes the dartos muscle of the scrotum which is thus formed from the superfic-ial fascia and spread over the scrotum, and it is the contractions of this which in the cold weather draw up the scrotum ~~and~~ make its surface present that rugous appearance so frequently noticed. This I notice merely en passant as we shall have

to enter more largely into these tissues at some subsequent time. As we follow this same fascia backwards, we find it becoming more laminated in its character and containing a quantity of fatty matter within its meshes, this splitting of the fascia is embarrassing to dissectors in endeavoring to trace it back. As this is removed from the neighbourhood of the anus, we bring into view first the

## Sphincter Ani

muscle. This has its origin as you may observe, from the point of the os coccygis, from which the fibres run forwards and laterally in the shape of a loop somewhat, to be again collected together in front of the anus to be inserted into a point of the perineum where many muscles meet, called the perineal centre, a slip also usually running forward to be inserted into the superficial fascia near to the scrotum. This muscle which runs between the proper inferior fascia of the perineum and the superficial fascia, serves to connect them and serves as a tenser to them the slip however being smaller than usual in the present case. This muscle is usually described as two separate disks, surrounding the anus on each side and being joined together at the points of origin and insertion, but if we can conceive of it as a simple elliptical plane ~~layer~~ of muscular fibres with a split in the centre for the orifice of the bowel, it will greatly simplify the character of the muscle. We have a portion of this muscle which is however distinct both in physical character and function, called the internal sphincter muscle, this is brought into view by turning out the lower edges of the portion first described, and is found to consist of a number of fibres on each side, running in the same direction but being of a pale colour, not red like the outer ones. These are the proper involuntary sphincterian fibres, and consist only of a number of the ordinary fibres which surround the intestinal tube every where in its course, collected together here into a ring surrounding the orifice. These are attached to those before described by a portion of cellular tissue which lies between them except at the posterior part where they adhere directly together by a very dense and direct attachment. It is through this, or in this intervening cellular tissue that abscesses are so frequently found from slight causes which opening into the bowel and outward by its side

produce those sinuous openings known as fistula in ano
The space between the rectum and the tuberosities of the
ischium is as you see filled up by a mass of fatty matter
placed here upon the principal of padding, to fill out
spaces which may be wanted, but which may not be
left vacant, as none such are permitted to exist any
where, - The rectum we know is liable to constant and
very considerable dilatation by the passage of indurated
faeces, - for which a considerable space is required, and
thus it would not have answered the purpose to have any
material here, which would have been incompressible,
As I draw this mass out, you see what a quantity
there is of it and how large the space occupied by it,
This also, as well as other analogous places, - serves as a
storehouse in which nature lays away a quantity of nu
-tritious material which may be floating in the blood
-above what is required for the present uses of the sys
-tem, - so that it may be drawn upon under circumstances
of wasting disease or starvation, which she sometimes
is subjected too, This mass, is as you see, very vascular
being traversed by small vessels in every direction, Now
this fatty matter when absorbed as in the emaciation of
of consumption leaves the cellular tissue and vessels beh
-ind, which from the loss of the supporting adipose
substance, is subjected to the constant succussions of
the cough, and in this way becomes diseased, and
gives rise to those extensive abscesses by the side of
the rectum so often met with in those pulmonary
diseases of a wasting character, attended by cough,
This fossa so filled by this mass of fat is called the
ischio rectal fossa, over the edges of which pass the
edges of the great glutei muscles, particularly when
we are in the erect position, these muscles make
constant pressure upon the mass and hence contrib
-ute to support the rectum, It was from a knowledge
of this fact that Dr Physic used to direct that child
-ren labouring under prolapsus ani should always
be directed to discharge the bowels in an erect positn
that the muscles pressing here should act as a pair
of hands applied upon the sides of the orifice to prev
-ent the occurrence of a protrusion, After having
drawn out this mass, you perceive at the extremity

of the fossa, a point where the obturator muscle covered by its proper fascia, comes in contact with the levator Ani, also covered by fascia, The point of attachment between these muscles is so weak however as to admit of a probe being readily passed up between them for the whole depth of the perineum, This point is worthy of attention in as much as it is through it that the knife is always passed in the lateral operation for stone, where as you see there is nothing of importance to be cut by it, On the anterior triangle of the perineum to which we now turn you see exposed a membranous layer which is the proper inferior fascia of the perineum being the lowermost of the three which go to the composition of these parts This fascia is attached upon each side to the rami of the pubis and ischii and is continued up to be identified with the ~~involucrum~~ the fascia immediately covering of the penis, and backwards to the orifice of the rectum where it takes a crescentic shape across the perineum and is reflected up the anterior face of the bowel to become continuous with, or to form the middle perineal fascia, By the arrangement of this fascia in this manner posteriorly, we see that any opening or rupture of the urethra which admits the urine to escape will not produce an infiltration of the cellular tissue by the side of the rectum but on the contrary will be forced forward under the fascia to infiltrate the parts around the scrotum, if it does not make its way upward by suppuration into the pelvis. Upon the outer side of this fascia we have here a portion of the dartos muscle inserted, which we shall have to notice more particularly hereafter, we now by a V shaped incision along the edges of the bones cut up and evert this fascia, when we have brought into view the proper muscles of the perineum, and first of these to notice is the

## Erector Penis.

This muscle arises from the tuberosity of the ischium, from whence it proceeds upwards and inwards covering the whole crus of the penis to be inserted into the involucrum or membranous covering of the penis, The action of this muscle is described to be that of erecting the penis, but I believe is intended rather to give it direction or hold it in place after erection has taken place, The crura of the penis are here observed coming off as roots from

the tuberosities of the ischium on either side, in the form of dense round cords, which converge, and join together for the formation of the proper body or Corpus Cavernosum of the Penis. The urethra is also observed above, being dilated by a bougie, below however it is as yet hidden from view by a muscle which is next to be noticed namely the

## Accelerator Urinæ

or ejaculator seminis. This may be described as a single muscle embracing the urethra, or as two separate muscles, one upon each side, uniting upon the middle line, If as a single one we say it arises by a forked origin from a tendinous membrane covering the Corpus Cavernosum Penis and running behind the urethra, - and from the ~~second~~ or middle fascia of the perineum on each side of the urethra as far back as the membranous portion, from which extensive origin the fibres run around the urethra, so as to cover it completely in a muscular belly, and then proceed to be inserted into the perineal Center opposite the insertion of the sphincter ani to which it is as it were an antagonist, both muscles generally acting at once, and hence affording fixed points for each other, This is quite a large muscle comparatively, being here however rather larger than ordinary say 2½ inches in length and very fleshy and strong, This muscle being attached to a tendinous membrane on each side which runs under the urethra, and running its self over it, will of course form a sphincter for this canal, and by its contractions so efface the passage as to drive out any thing which remains in them, Now we know that the bladder is emptied of its contents by the contraction of its muscular coat and also by the pressure exerted upon it by the abdominal muscles, but these must cease to act when there is no longer any water present, and hence would leave the whole Canal, nine inches in length full of ~~what~~ water after the contractions had ceased to be effective; this remaining water would then be subject to dribble out by degrees to the great inconvenience and discomfort of the person, Now by the arrangement and situation of this muscle, all this difficulty is overcome, for in its contractions every thing is forced out, and the canal collapsed, The difference in the

name given to it by different anatomists arises from the manner in which they have viewed it, as forcing out the urine or the semen, the which it also effects in the same way except by a kind of spasmodic contraction. This perineal centre to which it is inserted is rendered fixed for its action by the simultaneous action of the sphincter ani to which it is opposed. The existence of this perineal centre as a movable point was necessary from the fact that had a bony or fixed one been placed there, it would not only have interfered with defecation, but in the female totally prevented the process of parturition from taking place. The necessity for a point of insertion to some muscles, therefore gave occasion to others which might act as stays to this point, to render it stable whilst others acted. We therefore find some other muscles here running across the perineum to which it is now proper to revert, and the first of these is the

## Transversus Perinei

One upon each side of the median line, having their origin from the inner surface of the tuberosity of the ischium, from which it runs across to be inserted into the before mentioned perineal centre opposite to its fellow, the two of which serve to stay this point in the lateral directions from which they come. We sometimes find in addition to this another small muscle situated in this neighbourhood. This is very frequently deficient, but in this instance when the whole of these muscles are generally well developed, - those alluded to, are well exhibited. This muscle is called the

## Transversus Perinei alter

It lies somewhat deeper than the last, and is also longer arising like it from the tuberosity of the ischium, it pursues a course obliquely forward rather than directly transverse, and is inserted into the accelerator urinae muscle opposite the bulb of the urethra. This muscle serves merely to stay the parts laterally and support them in position during their contractions, and those which surround them are attached at the same points. Between the urethra and the tuberosities of the ischium in this region we see that there is nothing of great importance, in the triangular space which exists, and in this the knife is passed in the ordinary operation

and between the two layers of triangular ligament —

for stone. The instrument being introduced parallel with the urethra is carried on so as to divide these transverse muscles across, this being unavoidable in the operation. There is also a small artery runs across here below, or rather above the transverse muscle, called also the trans-versus perinei, which it is necessary to cut across, this is not a very large vessel, ordinarily not quite so large as in this instance, but yet sufficiently large to mask the proceedings somewhat by the discharge of blood to which it gives rise. After removing the accelerator urinae muscle we come upon the membranous portion of the urethra which we see here distended with a bougie and some clotted blood, and as we pass on downwards opening the muscle we see also the bulb-ous or pouched portion which exists in front of the triangular ligament. As we get back towards the perineal centre, we meet with two little glandular bodies, one on each side of the urethra, occupying a position astride of it as it were like the thyroid gland in the neck spans the trachea, — each of these little bodies has its excretory duct emptying into the urethra at this point. These little bodies are called Cowper's glands, and secrete simple mucous fluid which is poured into the canal to lubricate it and keep it in the condition proper and necessary for all mucous membranes. — Immediately behind this point we have the transverse muscles running across, around which the inferior fascia turns to become the middle fascia or triangular ligament of the perin-eum. This is a very simple manner of viewing these fascias, and I think much facilitates a clear understanding of them, which is so important to a comprehension of the various diseases and surg-ical operations in which these parts are im-plicated. What can be more simple than to commence with a layer of fascia (the inferior) say at the scrotum and carry it back over the muscles and urethra until you get to the transverse ones stretched across like a bar, and then turning it around these and carrying it back above the muscles and urethra to the angle of the pubis having in this last layer a hole for the passage of the urethra into the bladder. —

Lect. XLVI.

On Friday last, gentlemen we commenced the consideration the important structure of the perineum, At that time I mentioned to you the existence of three proper and peculiar fascias of the region, - an inferior, middle and superior. After laying off the skin ~~we came~~ and superficial fascia we came down upon the first or inferior fascia. This we found reflected up as it reached the rectum, being posterior to it the whole of the posterior triangle of the perineum, In this portion, which was formed by the line drawn across between the tubers of the ischium, we noticed the existence of the sphincter ani muscle composed of two distinct portions, - and the lateral edges covered by the edges of the great Glutei muscles of the two sides, We noticed here a fossa formed between the sphincter and the tuberosity of the ischium, which was limited above by the coming together of the levator ani and obturator internus muscles, the two portions of fascia covering which were attached together at this point. This ischio rectal fossa we found filled by a large mass of fatty matter placed here by the side of the rectum as a plug or padding by which the parts are supported. After noticing these with their relations to diseases about the parts, and noticing the effect of the pressure of the Glutei muscles upon them we proceeded to take a view of the anterior triangle, or proper perineal region in contradistinction to the other which is the anal region, This inferior perineal fascia was then traced forwards ^before^ upon the scrotum and backwards to be reflected up and turn forward again as the middle or triangular fascia or ligament, After raising up this inferior ligament as a curtain we found exposed below a number of muscles, a very clear view of which is represented upon this wax model, Thus we had first the accelerator urinae, surrounding the urethra and meeting upon the middle line, the erectores penis of each side covering the crura of the penis as they came from the rami of the ischium, - the transversus perinei muscles from the tuberosities, and the transversus perinei alter more deeply seated, in contact with the middle ligament, Many of these muscles, with the sphincter ani, we found running to be inserted at a common point near the middle of the perineum, forming the perineal centre, This was found to be movable and only made up

by the insertions of these muscles. This recapitulation I have deemed necessary in order to have a very clearly understood starting point for the succeeding demonstration of the yet most complex point of of the anatomy of this region. We have then upon the subject before us, these parts all cleared away in order that they may not encumber the view. This subject being retained although the parts are somewhat discoloured, on account of the full development of the surrounding muscles. We noticed in the last lecture to the existence of the bulb of the urethra anterior to this triangular ligament, and the manner of its attachment to it. Now this triangular or middle ligament is not a single layer, as we found the inferior one to be, but is double or has two layers, which as they proceed backwards diverge from each other, and contain between them the muscle of wilson, the membranous portion of the cowpers glands & the pudic vessels & nerves ~~urethra and the prostate gland, with those of Cowper, and the pudic vessels and nerves~~ & the sub pubic ligament The glands of Cowper were exhibited when the ~~ligament~~ was first turned up. These parts are well displayed upon this large drawing taken from nature in which the two layers are seen and the membranous portion of the canal which is wholly contained between them. This ligamentous membrane fills up the space between the rami of the pubis being attached firmly to these bones from the symphysis back to the margin of the anus where we have seen it continuous around the transverse muscles, with the inferior fascia before noticed. Thus filling the space in the triangular arch of the pubes, it is properly called the Triangular ligament; lying behind the muscles of which we have spoken it was of course hidden from view by them, and is now only fairly exposed. The opening by which the urethra is allowed to pass on its course to the bladder, exists in the membrane just one inch below the symphysis pubis, - and is distant from the margin of the ligament ~~anus~~ just half an inch, hence the whole depth of the ligament must be one and a half inches. This opening through which the urethra passes to become the membranous portion has here been carefully dissected out and presents a regular round free margin. This however by no means exists in the natural state of the parts: on

the contrary, the cellular tissue covering the urethra and that upon the ligament, by which the muscles &c are attached is perfectly continuous, and attaches also the pendulous bulb to the ligament below the opening. This ligament is very tensely stretched across between the bones, and forms the middle resisting partition between the interior of the pelvis, and the skin which forms the superficial perineum. From the tenseness of this ligament and direction observed by the urethral passage it becomes necessary that it shall make a curve in order to gain the opening after which the direction of the membranous portion is straight into the bladder, being like the female urethra from this point, being two inches from the triangular ligament to the bladder, and of a perfectly fixed nature, so much that its direction cannot be altered. Now by bringing down the penis and drawing it forwards, this canal may be rendered nearly, although not quite straight, as the parts will not yield to the extent of straightening it perfectly. In passing a catheter into the bladder, the end of it is very apt to be caught within the bulbous portion and of course resisted by the membrane against which it is attached,- sometimes becoming entangled in this loose pendulous part, and thus causing difficulty, we now see that by depressing the penis the instrument will rise and pass on the hole, and thence directly on into the bladder. The knowledge of the exact anatomy of these parts is of the utmost importance in these little operations, for they are required in every day practice, and to be accomplished with safety as well as dexterously, require to be thoroughly understood. This part which has been described is not to be understood as being the whole triangular ligament, as it is only the anterior layer as I before mentioned that is consisted of three layers. When this is dissected up, you notice that it is traceable up to the symphysis of the pubis from which it arises, or upon which it is inserted. As the position and relations of this must now be clearly understood I shall split it up through the centre, turning it off upon either side; by this I bring into view another very thick and strong ligament occupying the very top of the angle between the pubic bones. This constitutes a part of the bond of union between the bones and is called, the sub pubic ligament. This is formed between the two layers of the

middle fascia, we next notice here those two small bodies which we have already seen in connexion with the first layer called the glands of Cowper, These are well seen as I draw out the membranous portion of the urethra to which they are attached, their ducts emptying into the urethra beyond the bulb, These little bodies I have no doubt become very frequently the seat of disease particularly in the Chronic stages of gonorrhea and I believe do not in these cases attract the attention to which they are entitled, It is very easy to perceive that an inflammation of the lining membrane of the urethra may extend itself along the continuous lining of these ducts and affect the glands in such a manner as to produce those hardened tumours so often felt just in front of the anus producing great pain when the patient is in the erect position, and often interfering with defecation and micturition by producing painful sensations about the parts Indeed these inflammatory enlargements sometimes go on to the formation of abscess which being in this confined position not only becomes very painful but very dangerous to surrounding parts, A case has occurred to me very lately in which from symptoms which were referred to such an affection as this an incision was made by which the correctness of the diagnosis was proved, by the discharge of the matter from below this ligament and the subsequent recovery of the patient, These affections are frequently referred to diseases of the prostate gland and hence are erroneously regarded and treated for such whilst their real location is the small bodies now pointed out, This is of some importance to remember as it will in some cases vary the prognosis and treatment quite materially We next notice immediately beneath the anterior layer two small muscles which were described by Mr Wilson and hence called the muscles of Wilson or the Constrictores Urethrae muscles These are here very well exhibited as the muscular developments all are upon this subject, They may be seen surrounding entirely the whole membranous portion entirely meeting and joining upon the middle line, not only covering this portion of the canal, but also the glands of Cowper which is very unusual, They here hide entirely from view the membranous portion of the canal, being at least one third larger than they

are ordinarily met with and here seen to much more advantage, and affording a much better idea of their existence and situation. They arise by two sets of fibres one from the symphyses and the other from the ramus of the pubes, from whence they run down around the canal to join upon its lower surface, forming a complete band or sling by which it is suspended as it were from the pubic arch. This as described constitutes both the muscles of Wilson and Guthrie, - that portion from the symphyses being Wilsons whilst the part from the ramus is Guthries muscle. In this large painting which has been copied from the original drawing by Clift made from the dissection by Mr Wilson, these parts are very clearly shown, although the muscle is not nearly so well developed as in the subject before us being here as before noticed at least one third larger than the usual size in well formed individuals. The action of this muscle, or rather of these two for they must act in conjunction, will be to draw up the membranous portion and approximate the walls of the canal, thereby shutting off the communication with the bladder from without. In as much as we know that even when the bladder is very much distended and pressed upon not only by the fibres which constitute one of its coats, but by the abdominal muscles, - the urine does not flow out involuntarily we must have some means by which this is prevented and this is the muscle which gives us the voluntary power of resisting the force of distension even for a considerable length of time, except it be under certain deranging circumstances. This is in fact the sphincter muscle of the bladder which except in extreme cases it is impossible for it to overcome. It is subject in some instances to spasmodic action in which the canal is so closely compressed as not to admit of the smallest sized bougie to be passed through it. Inside between the two layers of this fascia we have also the internal pudic artery vein and nerves and a plexus of veins beside, together with the prostate gland. Behind these several contents of the space between, we have the posterior layer of this fascia to which we must now give attention. This arises from the inner side of the pubic bones around the symphyses and runs upward and backward in a sloping direction to be lost in or continuous with the pelvic fascia,

These two layers of fascia have intervening between them at their point of origin only the thickness of the pubic bone whilst from this point the diverge as they proceed in their courses, receiving the muscle of Wilson membranous portion of the urethra ~~the~~ prostate Gland &c. - the one being above the other below these structures. I next have to call your attention to a large and important muscle existing here which from its function has been called the

## Levator ani.

This muscle is seen in the lower part of the pelvis as a broad strong one, capable of supporting great weight. It arises from the pubic bone by its internal face and from the ischium and the ligaments of the pelvis, from which extensive origin the fibres proceed inward in rays to be inserted into the point of the os coccygis & into the Sphincter Ani muscle around the whole ~~some~~ circumference of the rectum, and also into the perineal centre, These thus form two ~~mus~~cular planes which running inwards and downwards to surround the rectum and be continuous with each other form a complete muscular funnel of great extent and power, These muscles close in completely the perineum above, and are the antagonists to the diaphragm and abdominal muscles, in the compression which they exert upon the contents of the cavity having an insertion into the upper edge of the sphincter muscles, they will also have the effect of antagonising this, as it acts from the coccyx to the perineal centre by pulling the orifice down to a level, which the others when they act have a tendency to draw up. Thus when the Sphincter muscle becomes relaxed and partly incapacitated from action by disease, this muscle will pull it up unresisted and in doing this will be very liable to prolapse a portion of the intestine which unopposed makes its way through the no longer resisting Sphincter, This constitutes one of the causes of the prolapsus ani which is met with in children and indeed is one of the most common of all the causes of this affection, It is by reason of this destruction of the antagonising power of the sphincter in resisting prolapsions of the rectum, that we have the rule laid down, never to divide the muscle upon both sides at once, nor even very often upon the one side

as such would be very liable to produce the affection under consideration by giving up the action power to the levator Ani. This should be remembered in the operation for fistula in ano, as well as in relation to the occurrence of prolapsions, as these pathological reasonings will very often be the only means by which a correct knowledge of analagous affections are obtained, - and will always lead, falacies of reasoning aside, - to the treatment most likely to prove successful from its foundation upon distinct principle. This muscle in its progress towards insertion passes down by the side of the Prostate gland which as before observed, is situated in front of the rectum. This body which we shall hereafter more particularly have to notice when treating of the generative organs and their appendages, - is shaped like a horse Chesnut, and lies below the urethra between the anterior and posterior layers of the middle ligament. It is enclosed in its proper and appropriate capsule and lies in contact with the anterior part of the rectum, being separated from its cavity only by the walls of the bowel, and the common cellular tissue which covers them. In the depth of this portion of the perineum this body lies one inch from the surface of the margin of the anus, surrounding the membranous portion of the urethra. It is a grey and somewhat solid body as you see when I draw it out, and is surrounded by cellular tissue as well as by its proper capsule. This body is very subject to disease particularly in old men, - but to this we shall have to revert afterwards, when studying its particular anatomy ~~There is another little muscle~~, The relations of this gland particularly its position with regard to the rectum is very important, and we shall therefore have to direct attention again to it directly after describing some of the neighboring structures. There is another little muscle in connexion with these parts which it is necessary to notice before proceeding to destroy it by incisions. This the

## Coccygeus.

This small muscle arises from the spine of the ischium and the parts immediately surrounding, covering the posterior sacro sciatic ligament when it becomes spread out into a thin muscle, which is inserted into the whole length of the os coccyx. Its action of course will be

to move the bone very slightly, but principally to support it in its position, or bring it back when pushed out. We now proceed to remove this levator ani muscle from below, after effecting which as you see we are not yet into the Cavity of the pelvis, there still being an intervening septum of division, This consists of the proper superior fascia of the perineum, lined upon its upper surface with the Common peritoneum of the Cavity, This it is very important to understand, and know the situation, for if it be cut in the operation for stone it will almost necessarily destroy the life of the patient by the inflammation of the serous lining and the formation of pus within this Cavity, By placing a lighted Candle within the pelvis you are enabled to see that in this direction from below upwards, although every part of the muscles and dense structures have been removed, yet that we are still not in communication with the pelvis, - very Clearly demonstrating the existence of the superior perineal fascia, or proper pelvic aponeurosis, We now have exhibited a Clear view of the extent of the perineum proper, and may see that upon the rectum it is full three inches in depth, whilst at the symphyses it is not more than one inch, To Complete this demonstration we will now open the rectum and exhibit its relations to the prostate gland more fully, By splitting it up thus precisely as in the recto vesical operation for stone, - we see the gland placed under and between the levator ani muscles and in direct contact with the rectum and urethra, being exactly so situated as to be compressed by the action of this muscle and thus have any secreted Contents discharged by it. This gland is much Concerned in most of the operations for stone, which must not be undertaken of course without a perfectly Clear idea of the anatomy of this region, and the relative importance of the various tissues which it is necessary to divide or to avoid dividing, the operation always being a serious one and to be undertaken with Caution.

Lect. XLVII.

Before commencing the consideration of the muscles of the thigh I wish to day to show you an upper and more distinct view of the superior perineal fascia or superpelvic aponeurosis, thus completing the demonstration of the perineum I hope in a manner clearly intelligable to all, - a thorough understanding of which is so necessary, and which is moreover so intricate in its anatomy. You here see again the two layers of the triangular ligaments, embracing between their folds the prostate gland beside other structures before noticed, The drawing which I here exhibit shows very plainly the situation and relations of these, and you notice here the prostate lying immediately in front of the section, covered by its capsule, and receiving another covering upon its upper surface, by the posterior layer of the triangular ligament whose direction as we have before seen is upwards and backwards to become continuous with the superior fascia, Around this prostate gland we notice a collection of veins represented here, which form the prostatic plexus. These vessels are here in great numbers here and are continued on to the bladder where they again form another collection upon this viscus called therefore the vesical plexus, these veins belong to the portal system and are engaged in carrying the blood back which has been so freely distributed to these parts. This prostatic plexus is unavoidably cut through in the operation for stone, from its position, - and thus gives rise in old men to severe hemorrhage at times, This is a fact frequently noticed thus in old men the operation is always attended with more hemorrhage than in younger ones, and generally of a venous character, This proceeds doubtless from this source as these vessels are always found enlarged in old cases, This may be accounted for very reasonably by supposing what must happen, namely that the stimulus of the stone must produce an hyperæmic condition of the vessels, and thus end in this venous congestion which is aided by the gravitation of the blood in these dependent parts. Whilst in young subjects the vessels and tissues are in a more perfectly healthy and resisting condition, and have not been so long subjected to the irritation of a foreign body in the bladder, which irritation this organ communicates to all the surrounding structures with which it is in connexion, or sympathetic relation, Upon the table we have the subject laid open by vertical cuts

through the symphyses pubes and also through the vertebrae and sacrum at the back portion, in such a manner as to expose the different structures without so far decomposing them as to destroy their normal relations, We notice here again the two layers of the middle or triangular ligament split open in such a manner as to expose the body of the prostate gland in its situation, the fas-cia being dissected up from its surface, It presents as you see a rounded form somewhat like the horse ches-nut, and is of a greyish colour, As we raise this portion of fascia from the gland and bring it forward we bring into view another small body of which two exist in contact with the bladder and behind the pros-tate, namely the vesicula seminales, These are placed as before stated in contact with the posterior face of the bladder and below the proper pelvic aponeurosis, The whole layer of this aponeurosis or superior fascia of the perineum is here exposed upon one side of the pelvis and is seen to form an entire sheet across it, the levator ani muscle having been stripped off below, We next have to enquire how this fascia gets here, or from whence it is formed. We have seen that the iliacus internus and psoas magnus muscles were both covered in closely by a process of fascia whose attachments we had occa-sion to examine somewhat minutely, This fascia is continued over the edges of these muscles and down to the linea ilea pectinea where it is attached somewhat firmly to the bone by cellular tissue, We saw that the psoas parvus muscle coming down from the vertebrae was inserted into this fascia, acting as a tensor to it, as we have found all the important fascias about the body have their appropriate tensors, We have noticed the origin of the levator ani muscle from the inside of the pelvis all around it nearly so as to form a muscular funnel in the centre of which passes down the rectum, - This fascia iliaca then after dipping over into the pelvis to become the true pelvic fascia is reflected off over these muscles the junction of which we found to constitute the top or upper limit of the ischio rectal fossa, - the obturator internus forming the outer whilst the levator ani formed the inner wall of the cavity, These muscles we notice

to be both covered by layers of fascia, and the manner in which this is effected we must now examine into. The pelvic fascia runs down until it comes to the edge of the levator ani, over the obturator internus, here it sends off a process to the obturator internus, and then splits: the one portion going down below the levator ani, to the rectum, and the other spreading on more horizontally in the upper face of the muscle, to the bladder. This process sent off to the obturator muscle is distinctly a part of the fascia for when the knife is passed down behind it it goes out between the muscles, whilst on the other side it comes upon the inside next the muscle. Thus we see that this levator ani is enclosed as it were between the two layers of this fascia, made by its splitting. We must next trace on the upper layer of this divided fascia on its course to the bladder, as it now forms the proper pelvic fascia or aponeuroses. This is extended on the muscle until it comes to the bladder before and the rectum behind, in the coats of both of which it becomes lost entirely being converted into the proper tissue of which these are formed. Thus we see that there is a portion of the pelvis at least 3 inches in length below this fascia, or below where the insertion takes place which forms the proper floor of the pelvis and roof or covering of the perineum. Where this pelvic fascia passes over the prostate gland it becomes continuous with, or receives into it the posterior layer of the triangular ligament which we have before traced back to this distance. We have next to notice in what manner the covering of peritoneum which these parts generally receive, gets into the pelvis so as to cover them. This comes over the anterior part of the abdomen, covers the anterior face of the bladder nearly down to the pubes, mounts over its fundus, then dips down covering its posterior parts between it and the rectum, down to within a half or three quarters of an inch of the upper end of the prostate gland, and within about three and a half inches from the orifice of the rectum or anus,- is then reflected off backward to the rectum up which it ascends covering its anterior two thirds and being reflected back loosely from the sides to the sacrum & spine where it is sometimes called the mesorectum. From this line laterally it is exten

-ded off upon the pelvic fascia which it covers back to the linia ileo pectinia and over the iliacus and psoas muscles to be continuous with that which lines the sides of the abdominal cavity. The bladder is here as you notice, stayed in its position in the pelvis by a fold of the fascia by which it is covered, reflected off on the side, - there also being a similar one upon the opposite side as we shall hereafter see when we come to examine the organ particularly. These are call-ed the lateral ligaments of the bladder, and receive also a covering of the peritoneum as it is reflected off laterally to get to the sides of the abdomen. We now having finished all that it is necessary to say in ord-er to make the subject of the perineum as distinct and clear as is possible for us, - shall proceed on to the consideration of the muscles of the lower extre-mity. Before taking up the particular muscles it will be well to notice that beneath the skin and common superficial fascia, we have the whole limb covered by a dense strong and fibrous investment called from its character and situation, the fascia lata femoris. This firm aponeurosis is intended to confine the muscles in their places whilst contracting and support them in the relaxed condition, as when they are deprived of its support we see them hang-ing loose, and apparently too long for the situation which they occupy. This fascia has partitions going down from it between all the different musc-les, surrounding them and forming proper compartments in which they may act, and move upon each other. This fascia lata we find connected above to the pubic bone, to the whole length of Poupart's ligament, and as we shall hereafter better see, to the whole of the crest of the ilium by its outer margin. From this origin it proceeds down around the limb like a tight stock-ing, being particularly dense and strong upon the outside of the limb. It is here more loosely connected by cellular tissue to the muscles below, than in other parts of its course, and hence abscesses are more apt to occur here. This thickening upon this part answers the purpose of supporting the body in a great measure when we stand upon one foot, for any length of time

thus forming an analogy in comparative anatomy, to that arrangement by which some birds as the heron, are enabled to stand for half a day upon one foot, watching for their prey. This could not be effected by muscular action alone, as this requires constant intervals of rest to keep it in integrity, Hence in these birds it is accomplished by a locking of the bones, a kind of semi luxation which produced at will renders the bones fixed in one position, whilst in man it is effected by the resistance offered by this fascia lata when made tense by this position. Upon the other limb of the subject this fascia has been stripped off in order to expose the various muscles which it covers, and which we must now proceed to notice; I first call your attention to a mass partly tendinous and partly fleshy, which comes over the brim of the pelvis to be inserted into the trochanter minor of the thigh bone, This mass as you see is somewhat triangular in shape with the base upwards, and situated as it is makes a kind of forced separation or wedge dividing the muscles upon the thigh from each other upon the upper part, The triangular space thus made contains beside these extremities of the iliacus internus and psoas muscles, the great femoral artery, vein and crural nerve, which come out under Poupart's ligament to go down upon the thigh, In this space the artery throws off the great branch called profunda, and it is also in some part of it that we cut to throw a ligature around the vessel in cases of hemorrhage &c. Running upon the outer margin of this space we find a beautiful muscle the longest in the body, called the

## Sartorius.

This has its origin from the anterior superior spinous process of the illium from which it pursues a winding circuitous route down the thigh upon its inner side principally being held in its position by the processes of the fascia lata which surround it, until it reaches the internal condyle which it runs round to be inserted under the aponeurosis of the leg, by an expanded tendon just below and inside the tubercle of the tibia The action of this muscle has given to it its name of sartorius as it bends the leg upwards and inwards in the form in which tailors place it hence it is said to be the tailors muscle, Another muscle much shorter than the last, comes from nearly the same

point of origin, namely the

## Tensor vagina Femoris

This muscle arises from the superior anterior Spinous process and crest of the ilium on its outer side, and is enclosed between two layers into which the fascia lata splits itself for its reception, being inserted into the fascia a small distance down the limb, Its action is to draw up this fascia and keep it tense and hence its name, it also will have from its direction slightly backwards a tendency to invert the toe by rotating the limb slightly The process of the fascia which runs inward under this muscle and also under the Sartorius must now be di-vided, - running also under the iliacus internus and psoas magnus as you see, This brings into view the next muscle which we have to consider, which is one of the heads of the great Quadriceps extensor of the leg, of old Albinus This I think is the best way in which to view these mus-cles forming an analogy with the triceps muscle of the arm, being however a four headed muscle instead of three, from the greater force and strength required here This then which forms one of the heads of this great extensor muscle is called the

## Rectus Femoris

from its straight direction, This arises by a rounded tendon from the anterior inferior Spinous process of the ilium, and by another portion from the bone just abo-ve the acetabulum, From these points it becomes fleshy and the fibres instead of running the whole length of the muscle run backwards to form a tendon upon the post-erior face of the muscle, which tendon is attached to the upper edge of the patella, or inserted through its inter-vention by the ligamentum patella into the tubercle on the front of the tibia, The action of this muscle will be to extend the limb when bent as you see it is made tense when the limb is flexed. This muscle has a bursa beneath it where it passes the joint, - and another bursa of a large size also exists between the tendons of the iliac-us and psoas muscles and the margin of the pelvis over which they play, acting like a roller to facilitate their motions, These bursæ are often subjected to injury and inflammation and are liable to be mistaken for disea-ses of the hip joint, as they cause much pain in the

motions of the part as these muscles and bursa seem to be connected with the capsule of the joint. A case has very recently come under my notice in which the physician in attendance believed firmly that some injury to the joint had been sustained, when the phenomena and rapid recovery of the case plainly denote it to have been the effect of tearing up the fibres of the muscle from this part of the capsule and giving rise to a synovial inflammation. The affection was produced by an attempt to kick a large ball with violence. Missing the mark however, a sudden and acute pain was produced, which doubtless proceeded from this cause as the direction and violence of the motion were calculated to produce. These points it is always well to recollect as they give great aid to diagnosis at times.

which joint

Our attention is next turned to the outer of the four heads of the quadriceps which with the inner of them, from their great size have been appropriately termed the vasti. The first of these is called the

## Vastus Externus.

And occupies the outer side of the thigh being separated from the thick fascia lata only by some loose cellular tissue, and thus predisposing to the formation of abscess about this part. This head arises by an immense sheet of tendon from the whole of the linea aspera, or raised line which is found upon the back part of the thigh, drawn out apparently by muscular action whilst the bone was yet in a soft condition. This line separates into two ridges as it gets to the lower part of the bone one running to each condyle, - this muscle then comes from the whole of the outer ridge entirely down to the condyle, and in addition by muscular fibres from the front face of the bone below the great trochanter. From this extensive origin it is inserted into the tendon of the rectus and into the patella being also continued down into the aponeurosis of the leg, and investment of the knee joint. We next come to the fellow to this one namely the

## Vastus Internus.

This although a very large muscle is not quite as large as the one last considered, but in other respects being very analagous to it. It gets its origin in the same manner as the last namely by a sheet of tendon from the opposite side of the linea aspera entirely down to the

internal Condyle of the femur, and also fleshy from a part of the anterior surface of the bone just below the lesser trochanter, as the other was below the greater, from whence like the other it is inserted upon the tendon of the rectus, side of the patella and fascia of the leg, but upon the inner side instead of the outer. The analogy is carried out here, with the triceps of the arm, as by this aponeurotic insertion these muscles may exert some influence upon the leg, even though the tendon of the patella were cut off, as this aponeurosis has a firm connexion with the bone upon each side of the leg. The fourth and last head of the quadriceps is smaller than the last and called the

## Cruraeus

or Cruralis, and gets its origin by a pointed beginning upon the upper front surface of the bone where it is covered by the rectus muscle, this origin is extended outwards and downwards to the linea aspera and inwards and downwards to the distance of an inch from the insertion of the adductors, thus covering the whole of the anterior part of the bone down to its lower extremity where it is inserted into the patella by its upper edge just beneath the insertion of the rectus. These four muscles are so joined and interlocked with each other below as not to admit of separation and it is therefore proper to consider them with the old Albinus as one muscle and call them by his name, The action of these conjoined muscles must be that of ~~flexing~~ extending the leg upon the the thigh, but if we stand erect and cause these muscles to act they will from the origin of some of them tend to bend the pelvis over upon the limb and consequently incline the body forwards. We noticed that the Cruraeus did not extend upon the inner side to the linea aspera as upon the outer, leaving a space of about an inch of bare bone at this point, - this may be remembered in cases when it becomes necessary to remove a sequestrum or perform any other operation upon the bone, but is not very eligible on account of the interference of the great vessels, - the better place being upon the outside where the fascia dips down to the bone, where there is no vessels or nerves, and where no muscular fibre need be cut.

Lect. XLVIII. I propose to-day gentlemen in the continuance of our subject to call your attention to the muscles upon the inner part of the thigh, and those upon the back part of the pelvis. These are all covered in, as we found them upon the front portion, by the dense membranous sheath called the fascia lata. On the posterior part this fascia takes its origin from the whole of the crest of the ilium and the processes of the sacrum, being extended down as a sheath over the entire thigh. This fascia preserves under any circumstances of contraction the symmetry and contour of the limb, the muscles of which without it would start out into unsightly masses when in action, and when not in action would hang in loose masses about the bone. The membrane is quite thin over the large gluteus maximus muscle where it is difficult to raise it separately, the processes dipping down into the muscle to surround the coarse fibres of which this muscle is composed, — being however, thicker upon the anterior part of it, where it is a firm membrane, quite strong and resisting and readily demonstrable. Having spoken of the muscles upon the anterior face of the thigh we shall now proceed to those upon the inner side of the limb, and first of these to a small muscle coming from the pelvis and inserted upon the thigh, this is the

## Pectineus.

So called from its origin upon the os pubis, which was formerly called pecten from some slight fancied resemblance to a comb, which it is now hard to discover. The muscle takes its origin from the body of the pubic bone at the upper part, and thence along the linea ileo-pectinea to the ileo pectineal protuberance, from which it forms a fleshy belly, which proceeds outward and downward to be inserted upon a slight rough ridge upon the os femoris which leads from the trochanter minor to the linea aspera, near the insertion of the iliacus and psoas muscles. Its action will be that of adduction and also of turning the knee outwards. This muscle is sometimes though ~~very rarely~~ permanently contracted, giving rise to deformity in the limb. This has occurred to me ~~only~~ in ~~two~~ many instances, in which it stood out in a rigid band upon this part of the limb. In these it becomes necessary to divide it which may readily done by a sub-cutaneous section, about its middle. This is almost always required as the muscle will be found to have undergone a fibrous degeneration to such a degree as to prohibit any stretching or extension. When we turn

down this muscle by dividing its origin which as you see dips over almost into the pelvis, we bring into view a beautiful long and slender muscle which from this has been called the

## Gracilis

This has its origin from the side of the body of the pubic bone just without the symphyses, and also from a portion of the decending ramus of this bone, From this tendinous point it forms a long fleshy belly proceeding straight down the inner margin of the thigh behind the internal condyle, to be inserted by an expansion of its tendon under the aponeuroses of the leg and under the sartorius muscle, upon the tibia below its tubercle, The expansion of these tendons here present the appearance somewhat of the pes ansenina or gooses foot. The action of this muscle will be that of flexing the leg upon the thigh, and is also one of those muscles concerned in station, by which the pelvis is held in steady equilibrium over the limb when this is the fixed point as in the standing posture, We next come to a large mass of muscles, situated upon the inner side of the thigh, and filling up all that space between the two bones, which would otherwise be left unoccupied, These are called collectively the triceps adductor muscles, being divided into three heads, to which might very well be added the pectineus which is also an adductor and would make it a quadriceps adductor, The first or most superficial of these parts we shall now notice, and is called the

## Adductor Longus

The origin of this portion of the mass is from the upper and anterior part of the pubic bone by a short tendon just beside the origin of the pectineus, from whence it runs downward and outward to be inserted into the linea aspera along the middle third of its course. The next which is partly covered by this one is called the

## Adductor Brevis

This arises from the pubic bone between the symphyses and the foramen thyroideum from whence it runs outward and downward to be inserted into the linea aspera in its upper third commencing just below the trochanter minor, When this short although strong head is turned off we have brought into view the

longer parts which has as we shall see a very extensive origin, which like all the rest, is perforated in every direction by the arterial branches which supply them. This is called the

## Adductor Magnus.

This muscle also has its origin from the pubic bone over nearly the whole face up to the thyroid foramen and from the tuberosity of the ischium, from which it forms a thick fleshy belly running to be inserted into the whole length of the linea aspera from the trochanter minor down to the condyle, and also by a tendinous prolongation into a pit on the head of the femur or ~~bottom~~ condyle. Thus we see how they are all connected upon this linea aspera being indivisable here, and hence the propriety of the name of triceps adductor, connected with the insertion of this muscle, we have the passage of the great femoral vessels around the thigh. These pierce the tendon at the junction of the middle with the lower third of the bone, getting through not only the adductor magnus but also being overlapped by a portion of the tendon of the longus. The artery after entering these tendons passes very obliquely backwards and downwards, so as to emerge ~~at~~ the junction lower with the next fourth of the bone, where it takes the name of popliteal and looses that of femoral. In injuries about these parts it is sometimes necessary to take up this artery when it passes the adductors. To effect this we must cut down upon it at the junction of the middle with the lower third, and then with a common grooved director divide the tendon of the adductor longus over the vessel. It is thus brought into view, when the sheath may be opened and a ligature cast around the vessel. The action of this triceps adductor muscle will of course be to bring the limb in when it has been carried outwards by other forces, it will also from its insertion along the linea aspera which is behind the transverse longitudinal axis of the limb, have the effect of turning the knee outwards, and consequently everting the toes. When the body is in the vertical position it will from its origin on the pelvis aid in flexing that upon the limb, acting in concert with others in preserving the body in station. In this action all the muscles surrounding the joint are called into action equally, having the effect of stays in poising the trunk erect over a very movable joint. Thus when any one set become paralysed from any cause we are not surprised

thus the individual falls down immediately from the loss of these stays. As for instance a musket ball passing through the fleshy part of a limb, and giving little pain or injuring only slightly, will make the most courageous individual fall, from the sudden palsy of some of these muscles, which is apt to occur from such an accident. Now having seen the muscles upon the ilium and part of the thigh we must turn to those upon the back of the pelvis and thigh and first of these to the large one which we noticed in connexion with the fascia namely the

The Ext Iliac muscle was the Pyriformis

## Gluteus Maximus

These gluteii muscles of which there are three covering the external surface of the ilium, ~~were formerly called the iliac external~~ muscles in contradistinction to the internal iliac which ~~we~~ have already studied, They are now ~~known called~~ glutei and distinguished as the maximus

have one at [illegible] medius and minimus. At the lower part of these muscles where the fascia covering them is thick and strong, we have sometimes developed tumours of a fibrous character ~~upon~~ it, a case of this kind being under my charge at present in a neighbouring City. These tumours it is always necessary to scrutinize very closely, and judge very carefully as to their character before attacking them with the knife as they may be confounded with others of a serious nature, This larger gluteus muscle, is as you see somewhat triangular in shape, and judging by the number of its fibres must be possessed of great force in action, It gets its origin from the posterior part of the crest of the ilium and from the whole side of the sacrum and coccyx, as well as from the sacro sciatic ligaments, that portion from the ligaments being folded under as it were, in such a manner as to support the mass of fat by the side of the rectum which we have before noticed, From this extensive origin the fibres run in a thick plane obliquely forwards and downwards and terminating in a strong tendinous expansion which is separated into two parts, Passing over the outer side of the trochanter it has between them a large loose bursa filled with synovia, whereby the motions are rendered easy, the one portion of the tendon being inserted into the outer lip of the linea aspera along its upper third, whilst the remainder is

inserted upon the fascia lata femoris, By this arrangement great advantage is gained in the action of this muscle, as it not only is attached to the upper part of the bone but also through this fascial expansion upon the whole limb ~~to it~~ which has been seen to be surrounded with the fascia. The action of the muscle is to draw back the foot when it has been advanced and is thus very much concerned in locomotion, It also has the action of everting the toe from its insertion upon the linea aspera, In stooping it also exercises the function of supporting the pelvis and body when stooped in this position the acetabulum being a very movable point, We next come to the consideration of the second of these called the

## Gluteus Medius.

This muscle originates from the anterior four fifths of the crest of the ilium by its outer lip, and also from the outer face of the bone down to the semicircular ridge upon the dorsum of the bone, This thus occupies the front part of the bone whilst the other is upon the back. From this extensive origin as well as from the inner face of the fascia which covers it, it runs down to be inserted upon the outer top of the trochanter major, This is one of the muscles which it is necessary to divide in the amputation of the limb at the hip joint, The action of this muscle will be different as the different portions of it are concerned, for it must be always remembered that muscles act as parts, as well as in collective masses, thus infinitely modifying their force and direction, The posterior part will have nearly the same action as the gluteus maximus, whilst the ~~posterior~~ anterior portion will tend to invert the toes by drawing the great trochanter inwards, Only about one third of the muscle however can have this action, as the origin of all the other two thirds will prevent it. The third one of these muscles situated upon the outside of the posterior part of the pelvis, is called the

## Gluteus ~~Medius~~ Minimus

This muscle gets its origin from the dorsum of the ilium below the semicircular ridge, from the lip of the acetabulum and also from the capsular ligament of the joint,- The bone however affording the principal part.- When we say origin from bone, it must always be taken as meaning from the periosteum covering the bone for no muscle is found under any circumstances to arise from the bone itself, From this extensive origin it runs to be inserted upon the upper anterior portion of the great trochanter, beside the medius just mentioned, This muscle will serve

-partly as a flexor of the thigh upon the Pelvis, and also as an abductor by drawing the trochanter upwards. This muscle will also aid in progression, and tend principally to turn the toes inwards, being with the tensor vaginæ femoris the only muscles producing this motion to any considerable degree, whilst there are a number that have the opposite tendency or will turn the toe outwards. These we must now examine. They are generally found coming out from the pelvis through the sciatic foramina formed by the extension of ligaments across from the sacrum to the borders of the notches in the Bones. These foramina were necessary in order to admit of the passage of the great sciatic nerve with the sciatic vessels, and also the gluteal vessels and nerves, the redundancy of space being filled up by plugs constituting these muscles. These filling up the holes, prevent the occurrence of hernial protrusions which would otherwise be liable to occur, and which sometimes indeed do occur from a deficiency in the muscles. The first of these muscles requiring our attention is that called the

## Pyriformis

from its angular or pear shape. Turning off the roots of the great sciatic nerve we find this muscle arising from the sides of the three middle bones of the sacrum inside the pelvis. From this origin we have the muscle running obliquely downward and outward through the upper or greater sacro sciatic foramen to be inserted in the pit or digital fossa at the upper base of the great trochanter. Below this muscle we have the great sciatic nerve and also the sciatic vessels, in their course to the lower extremity, and above, through the upper part of the notch, we have the gluteal vessels and nerve making their exit from the pelvis. These emerge at a point corresponding to the posterior edge of the gluteus medius, and the anterior edge of the gluteus maximus. And it is from this fact that in cases of Potts disease of the spine, or in psoas abscess, the purulent discharge instead of following the usual route to point by a tumour in the groin, follows down the sheath of the vessels and along that of the gluteal as it passes out over the pyriformis, when it makes a small tumour upon the buttock corresponding to this point. In the dense cellular tissue found here the matter forms to itself a cyst, feeling hard to the

touch, - movable and devoid of fluctuation, Being famil-
-iar however with the anatomy of this region, and that
inside the pelvis, - and also with the ordinary seat and
symptoms of the curious disease alluded to, - a surgeon
will always exercise great caution in the diagnosis of a
tumour occupying any part of this region before he decides
to attack it with his knife, A patient some time since
came up from Cape May, and presented herself to me for the
removal of a tumour occupying this situation, I carefully
examined her spine and back, but could detect no tender
point upon it, I then enquired particularly whether she or her
family had ever been subject to scrophulous disease, to which
questions she replied negatively, Not perfectly satisfied how-
-ever I proceeded to examine her neck for myself, and there
found the scars of scrophulous ulcers, - upon another exam-
-ination of the tumour I was so struck with the belief that
this was a purulent deposite of the kind mentioned that
I declined the operation, for which however the patient was
very anxious, from the fact as I ascertained, that she was
about to be married, and with the tumour, could not lie
well upon her back, Several cases of the same kind have ~~the~~
since presented themselves in which the greatest care was nec-
-essary to prevent the occurrence of disastrous mistakes,
The action of this Pyriformis will of course be to evert the toes as
before mentioned, by revolving the limb upon its long axis,
Another muscle has its origin within the pelvis and inserted
upon the thigh, this is the ~~Ob~~

## Obturator Internus

So called from its obturating or closing up the large foramen
thyroideum which we have noticed in the bony structure of the
pelvis, This foramen in the recent state is closed up by a
membrane called the thyroid ligament, which is pierced near
the top for the passage of the obturator vessels and nerves,
From the whole of this membrane with the exception of this
upper part, - and from the surrounding bones, - also from the
ischium upon the plane of which bone it forms a soft fleshy
cushion of about three quarters of an inch thick, upon which
the childs head rests whilst within the lower pelvis, in such
a manner as not to be subjected to the contusion which the
less protected bone would have been liable to produce, From
this extensive origin the muscle becomes condensed and makes
an angle by which it emerges from the pelvis through the

lesser sacro-sciatic notch, along with the pudic vessels and nerves. When it thus passes out, it becomes pretty tendinous and plays over the spine of the ischium as over a trochlea whence it runs to be inserted in the same digital fossa and near the same point as the pyriformis. In tracing out the tendon of this muscle it is necessary to lay aside others with which it is in connexion and which we must now proceed to notice, these are the

## Gemelli

The two of which have sometimes been described as the marsupial or bag muscle from the fact that they form a bag or sheath to the tendon of the last named muscle as it passes out of the pelvis. In separating them from this tendon however they are found to consist of two muscles, and are hence termed from their relative position inferior and superior. These arise, the one upon each side of the obturator tendon, from the tuberosity and body of the ischium, effecting a junction both behind and before the tendon, and run with it to be inserted into the digital fossa near the latter muscle. Their action with that of the obturator will of course be similar entirely to that of the pyriformis from acting from the same direction upon the same point.
The next muscle to which I will ask your attention is situated a little below and is called the

## Quadratus Femoris

From its having a somewhat quadrangular shape. This although a short muscle, contains a considerable number of fibres and therefore must be proportionally powerful. It takes its origin from a roughened line upon the outer face of the tuberosity of the ischium from which it runs across in a slightly oblique direction to be inserted upon a rough line leading from the trochanter minor ~~to the linea aspera~~ to the major ~~sometimes~~ called ~~the intertrochanteric line or~~ linea quadrati. The action of this muscle will be to evert the foot and to abduct the limb, a which should be particularly remembered in relation to all these muscles, as they are much concerned in fractures of the bones. When the limb is fixed their action will of course be to turn the pelvis, which then becomes the movable point, in an opposite direction,

Lect.
XLIX

Of the muscles whose office it is to rotate the thigh upon the pelvis or the pelvis upon the limb, there is one yet remaining undescribed, and with its consideration gentlemen we shall commence the lecture of to day, Those to which we have already turned our attention, of this class, have been the pyriformis, the gemelli and the obturator internus, and that now to be studied is called the ~~ob~~

## Obturator Externus

Named thus obturator from the same reasons which applied to the internal one, - and externus because found situated upon the outside of the pelvis in distinction from the other. Its position therefore being in direct contrast to the other has thus designated it, This muscle takes its origin from the opposite side, or external side, of the same Obturator ligament noticed in connexion with the internus, and also from the pubic and ischiatic bones surrounding the foramen thyroideum, from which it forms a tendon which surrounds the joint in the sulcus between the tuberosity of the ischium and the thigh bone, running near the acetabulum to be inserted into the same digital fossa with the other muscles before noticed, This muscle is very deeply placed, lying beneath the pectineus, the adductors, - and the tendon of the iliacus and psoas muscles, running under the latter in close connexion with the capsule of the hip joint, To expose the tendon of this muscle in its route to its point of insertion we must first remove the gluteus maximus and medius, and then lay aside the great sciatic nerve which always runs down through the middle of the space covered by these muscles, We next come upon the Quadratus femoris which being divided gives us a view of the tendon at its insertion, We see now that it forms a round tendon and is inserted as before mentioned at the foot of the great trochanter along with the pyriformis, This muscle will not like some of the others noticed tend to adduct the leg, but will roll it outwards and draw it back when flexed upon the thigh. The remaining muscles which we have to consider in connexion with the thigh proper, ~~and~~ pelvis, are those situated upon the back part of the limb and constitute the the proper hamstring muscles. One of which you have observe to have been ruptured, the probable cause of which it will perhaps be worth my while to explain to you, in as much as you may be asked to account for such a

thing having occurred in cases of some importance. as in post mortem examinations in cases of suspected violence. It is known to you all doubtless that after death there occurs a condition of rigidity in the muscles which will not yield to any force applied. This is termed Cadaveric rigidity and after a time, longer or shorter in different cases, is dissipated, and the bodies are left in a flexible condition. Now when the body is allowed to remain after death in the bent position in which death sometimes occurs the limbs become fixed in this position by the cadaveric rigidity and any effort which is sufficiently powerful to straighten them must rupture some of the tissues. This rupture occurs through the fibres of the muscle as you see, rather than through the tendon, which offers the greater resistance. This rupture of muscles is often met with and is thus to be accounted for. There are three of these proper hamstring muscles upon the back part of the thigh, all of which get their origin with the exception of a part of one, from the tuberosity of the ischium. These are not placed here loosely between their points of origin and attachment, but beside being covered in by the great fascia lata, are surrounded each by its separate envelope sent down as processes from this fascia as you see upon the opposite limb. This fact before only mentioned is here clearly demonstrated, exhibiting the great difference between this and the side upon which the muscles are dissected out and lie loose about the limb. The first one of them to which I will ask your attention is the one now raised up, and called the

## Biceps Flexor Cruris

This muscle alone forms the external hamstring fold and is very analogous to the Biceps Flexor Cubiti of the arm as we shall see. It arises like the Biceps of the arm in connexion with another muscle, - from the tuberosity of the ischium, by its long head, and by the short one from the outer margin of the linea aspera commencing just below the insertion of the gluteus maximus, from which point it is continued down towards the condyle, where it ceases and runs off to unite with the other or long head, shortly after which they form a strong round tendon. This afterwards

behind the joint upon its external side to be inserted just below the knee upon the head of the fibula, being also inserted by a tendinous expansion into the aponeurosis of the leg, thus carrying out the analogy with the Biceps flexor Cubiti. This external hamstring muscle is somewhat deeply placed, but not so much so however as to prevent its being divided in safety where it has become permanently contracted, for in these cases it will stand out in relief when an attempt is made to extend the flexed limb. In its division it is necessary that the knife should be so used as to cut all the muscular fibres, as the escaping of a few of them would complicate the treatment very much. It is also necessary here to be very careful not to divide or injure the peroneal nerve, which branches off from the great sciatic at about this point. This may generally, however be made so tense as to be felt and thus avoided. The action of this muscle is that of flexing the leg upon the thigh and after this has been effected a further contraction will extend the thigh upon the pelvis. The next muscle to notice is that which analogous to the coraco Brachialis, arises in conjunction with the Biceps. This is here called the

## Semitendinosus

from ~~arising~~ becoming tendinous about half way down its course. This muscle arises fleshy from the tuberosity of the ischium in common with the long head of the biceps, and soon becomes tendinous upon its inner face, terminating in a round tendon about half way down the thigh, which tendon goes to be inserted upon the tibia near the insertion of the gracilis and Sartorius muscles, sending also an expansion to be inserted into the aponeurosis of the leg. This which is one of the two internal hamstring muscles, like the Biceps will by its action flex the leg upon the thigh and extend the thigh upon the pelvis. We next proceed to the remaining internal hamstring muscle which is the one sustained in this case. This is called the

## Semimembranosus.

As its upper and lower fourths are of a membranous character, the middle only being fleshy. This muscle arises by a tendon from the ~~inner~~ outer side of the tuberosity of the ischium, leaving still one facet of the tuberosity unoccupied. This in the recent state is covered by the muscles of the parts and the thick mass of fatty matter which we find here beneath

the skin, and is the point upon which we sit, The muscle soon becomes fleshy, and again tendinous and is inserted into the leg and connecting ligaments by three separate points as follows. The first division proceeds directly down in the form of a round tendon to be inserted upon the back part of the head of the tibia about half an inch below the joint into which you see this instrument now passed, The second part which you see expanded over the handle of the scalpel crosses over the back part of the joint over the popliteus muscle to which it forms a sheath, and is inserted into the outer condyle of the femur and into the head of the tibia, In addition to these, this tendon sends another strong process directly across behind the articulating contact of the bones, to be connected with the posterior ligament of the articulation, or the ligament of Winslow as it is often called, Like those before considered this muscle will flex the leg upon the thigh and extend the thigh upon the pelvis, These muscles are also occasionally liable to deformity by rigid and continuous contraction, and in such cases when necessary may be readily divided with a tenotome through a small puncture in the skin, In doing this it is necessary to remember that the semimembranosus lies deeper than the other, although both may be reached without difficulty, As each of these is surrounded by a strong process of fascia, this too becomes contracted and thrown into bands which resist sometimes even after the tendons of the muscles have been divided, giving rise therefore to the necessity of another operation for the purpose of dividing this, Cases of this kind are given in a plate of my Surgery, in which the mode thus laid down was fully successful, Some anatomists in their descriptions make four internal hamstring muscles by including the gracilis and Sartorius with the two first mentioned, but these do not in reality constitute the ham string being situated on the side rather than behind, We have now to pass on down to the consideration of the leg, where we have first to remark beneath the integuments, an extension of the fascia lata femoris down upon the leg, having become thickened about the knee by the acc

-ession of new fibres so as to form the involucrum of the joint. We find it here also sending in processes between the muscles which as was the case in the arm serve to give attachment or origin to many of the muscular fibres. When we attempt to strip this off we find it firmly connected to the anterior and inner face of the tibia requiring some force or dissection to detach it. When it reaches the ankle joint we find an arrangement exactly analagous to that about the wrist, in the formation of an anterior annular ligament. This is stretched across from the internal maleolus and the top of the scaphoid bone upon the inner side to the external maleolus and margin of the os cubois without. thus serving the same purpose as at the wrist, - of binding down the various tendons which pass under it, and preventing them from starting out during the contractions of their respective muscles. The arteries veins and nerves also pass out as you may see, under this ligament. We may now proceed to the consideration of the individual muscles, and first of those upon the anterior face of the leg, - and first of these to that called the

## Tibialis Anticus

This muscle arises from the head of the tibia in part and from the whole outer side of this bone down to within three inches of the ankle joint, and also by some fibres from the white shining membrane which connects the two bones of the leg, called the interosseous ligament. Although thus acquiring by a constant accession of fibres nearly to its place of insertion, it yet grows smaller as it decends, finally becoming entirely tendinous. After this it passes under the annular ligament, a division of which shows that small processes of fascia are sent down on each side of each tendon to hold it in place. These tendinous passages we always find lined by synovial membrane which is generally continued down the sheaths of fascia in which the tendons are enclosed. These sheaths of fascia it is necessary to become acquainted with as it is sometimes requisite to divide them in affections of the bursal membrane below. These tendons often have additional bursæ in their routes when they pass over some point more than ordinarily projecting, in the bones beneath. The tendon of this muscle thus passes downwards and inwards across the foot, to be inserted upon the internal cuneiform bone

at the internal margin of the foot near the base of the metatarsal bone of the great toe. In that form of Club foot known as Talipes Varus, in which the heel is raised, and the inner edge turned upwards, this muscle is almost always at fault, though not always necessary to be divided, as when the tendo achillis is divided and the heel brought down to its proper level, this may sometimes be reduced to a natural condition without division. The Artery nerve and vein you see pass beneath the ligament upon the outer side of this tendon, where they have a separate passage under the ligament. The action of this tibialis anticus muscle is to turn the inner edge of the foot upwards and to flex the foot upon the ankle by its attachment to the ~~tarsus~~. Upon the outer side of the upper part of this muscle we have next the

## Extensor Communis Digiti Pedis.

This arises from the outer part of the heads of the tibia and fibula where they are in connexion, - from the interosseous and intermuscular ligaments, and from nearly the whole length of the anterior ridge or angular edge of the fibula. From this extensive origin it becomes tendinous, which tendon after passing beneath the annular ligament splits into four, one of which is distributed to each of the smaller toes, being inserted into the phalanges at each joint where it spreads out so as to form a portion of the capsular ligament for these joints. This will act by extending the smaller toes and if carried further will flex the foot upon the leg. It will be observed that when the foot is extended these tendons all lie flat upon the back and make no projections, but when contracted as in the ordinary walking position they occupy a considerably larger space, increasing the circumference of the foot by three fourths of an inch. Hence when a tight bandage is put upon the foot when in the extended position, and the patient afterwards put upon his feet to walk about, he suffers great pain and inconvenience from the bandage. This is a point which should be remembered in such cases. Between this muscle and the tibialis anticus at the lower portion of the leg we have another muscle called the

# Extensor Proprius Pollicis Pedis.

This muscle arises from the fibula along its lower two thirds also from the interosseous ligament and even some fibres from the tibia, It forms a tendon as it approaches the Anterior annular ligament under which it passes through a distinct groove and lined by a distinct synovial membrane, until it reaches the great toe upon the phalanges of which it is inserted for the purpose of extending it distinct from the remainder of the toes, The artery we see during the upper fourth of its course lies between the common extensor of the toes and the Tibialis anticus, but for the remaining three fourths is found between the last named muscle and the extensor proprius pollicis, - Another muscle exists upon the lower anterior part of the leg, which is in fact only a portion of the common extensor analogous to the Annularis of the hand, - which has received a different name, this is called the

## Peroneus Tertius

This has its origin as a part of the common extensor, from the lower part of the fibula, whence it forms a tendon which passes under the annular ligament to be inserted into the base of the metatarsal bone of the little toe and by a fascia or membranous expansion into the ant portion of the os calcis, This muscle acts by pulling upon the outside of the foot, and thus antagonises in a measure the action of the tibialis anticus. - Another muscle which we have here upon the back of the foot is called the

## Extensor Brevis digiti Pedis.

This arises from the anterior part of the os calcis, and after forming a thin fleshy belly on the dorsum, goes to be inserted by small tendons with those of the long extensor on the four inner toes, leaving the small one unsupplied, This muscle has no analogue upon the hand, and acts by assisting the common extensor, From the outer side of the fibula we have two other muscles arising called peroneus primus or longus and secundus. - peroneal because they arise from the fibula which was formerly called os peroni the first of these which we shall take up is the ~~Peroneus~~

## Peroneus primus.

or Longus arises from the upper fore part of the fibula, from the interosseous ligament, and by many of its fibres from the intermuscular septa which separate it

from the neighbouring muscles. From this origin the fibres proceed straight downwards and form a tendon which passes in a groove with the tendon of the next muscle, behind the external malleolus, thence through a groove in the side of the os calcis by which it gains the sole of the foot, across which it runs diagonally under the ligaments and fascia through a groove in the os cuboides to be inserted into the internal cuneiform bone, at a point just opposite to the insertion of the tibialis anticus, whose action it seems most completely to antagonize by turning the outer edge of the foot outwards and upwards. The course of this tendon and its deep position were pointed out when we were studying the ligaments of the joints, at which time I observed that I had no doubt but that many of the pains and anomalous affections of the sole of the foot were entirely due to accidents or injuries of this tendon in so exposed a condition and so confined as not to admit of easy treatment. The next of these is the

## Peroneus Secundus.

Which arises from the lower two thirds of the fibula as well as from the interosseous and intermuscular membranes, forming a tendon as it gets to the external malleolus, it passes behind it with the tendon of the primus, in the same sheath, going to be inserted into the base of the metatarsal bone that sustains the little toe, and also by a membranous expansion into the anterior part of the os calcis. This muscle with the ~~tertius~~ and longus complete the antagonism to the strong tibialis anticus and thus produce an equilibrium of action by which the foot is uniformly extend-ed upon the leg. In consequence of a rupture from sprain or cut of the annular ligament which confines these tendons they are set loose and start out over the malleolus, when instead of being extensors they become flexors of the foot and thus give rise to deformity. In two or three such cases which I have met with in the course of my practice, the only remedy which could be applied with any benefit accruing was a division of the tendons by which they were forced to form some new attachments to replace the natural ones, the limb always being very weak after-

**Lect. L.** I had occasion when speaking of the Gluteal muscles, or rather the fascia which covers them, to mention to you, that fibrous tumours were frequently developed upon this fascia, and I mentioned a case then under my care wherein such an one had occurred, I have since had to remove another of the same kind and from just the same situation, which I show you here, having been placed just where I now place it upon the fascia. These tumours after being carefully made out, are removed without any difficulty or danger, in the ordinary manner by a simple incision through the skin, with dissection of it from the tumour. I have to day to call your attention to the remaining muscles upon the leg and foot, but first to the extension down upon the back of the leg, of this Fascia lata femoris. This in its passage over the back of the knee joint receives an accession of fibres from the tendons of the hamstring muscles, and from the ligaments of the joint, from which it proceeds downwards enveloping the muscles, and binding them down as in the front. as it gets to the lower part of the limb it passes around the tendo achillis so as to form a perfect sheath for it. not being simply extended over its posterior face, but dipping down on each side into the sulci, from which it is again reflected off on each side. In the contractions of this ~~ten~~ don in the production of Club foot, this sheath is also very liable to be contracted, in which case division is necessary to bring the foot to its proper place. In addition to this superficial one, we have a deeper seated muscular aponeurosis passing in beneath some of the muscles from one side of the limb to the other, this is also a very strong membranous expansion which divides the muscles here into a superficial and deep seated layer, which division is often very advantageous. This aponeurosis passes from the margin of the fibula upon the one side, nearly straight across to the margin of the tibia on the other, forming a complete septum, or partition between the two sets, at each insertion all the way down it becomes continuous with the superficial layer, and when it comes down to the ankle joint, the reflection of the two combined on either side being firmly attached upon either malleolus, form the internal and external ligaments by which the tendons and vessels are held firmly in their places, thus supplying what was

called the posterior annular ligament in the case of the wrist joint. These ligaments also being here attached to the calcis and astragalus. Being continued down from these points over the sole of the foot it forms a very strong ligamentous expansion, called the plantar fascia or aponeurosis, exactly analogous to that which we found in the hand where it was called palmar. This, similar also to that of the hand, — is divided into three portions, which although somewhat continuous posteriorly, have depressions between them which mark the processes sent down to the parts of the foot below it. This is attached firmly to the os calcis posteriorly, and the middle portion is divided into four processes, each of which is split for the passage of the flexor tendons and inserted by two slips into the sides of the base of the first phalanx where they are continuous with the extensor tendons and those of the lumbricales, in precisely the same manner as in the hand. We sometimes find this portion dividing into five processes one to each toe, but in general the inner division of the aponeurosis goes to the great toe after covering the muscles on the inside of the foot. The outer portion is extended over the proper muscles, and edge of the outer margin of the foot, when it is attached to the various bony points of the tarsus and metatarsus. This structure is of very great thickness and strength as you see it preserves its shape and form when dissected off. It is stretched tensely across the bottom of the foot forming as it were the cord of the arch, which the structure of the foot assumes. And protects the various tendons vessels and nerves which run beneath from injury by the pressure of the incumbent body. It is frequently found contracted in many of the varieties of club-foot, in which cases it becomes necessary to divide it, which may be done without difficulty. We now proceed to the consideration of the muscles on the back part of the leg, and first of these to the superficial layer which constitute what is called the calf of the leg. This calf is constituted by the triceps extensor ~~[illegible]~~ surae as it may very well be called, being inseparable after a particular point. It is generally described however as composed of two muscles which unite to form one

large tendon, the outer one of which we shall first take up under its most common name of

## Gastrocknemicus Externus

This is a double headed muscle, the two origins of which are from the Condyles of the femur, and from the rough lines leading to these Condyles where they are connected with the Capsular ligaments of the joint so they pass over it, - a dis-section from which will open the Cavity of the joint, This doubtless has an object, which appears to be the drawing out of the Capsule so as to prevent its being pinched by the motions of the joint. These two heads from the inner surface of each condyle, after running a short distance, coalesce to form the body of the muscle which nevertheless has a middle seam or raphé down its Centre externally, the inner surface of of the muscle presents as you see a smooth shiny tendinous sheet which at lower part of the leg is inseparably connected with that of the muscle beneath, Between the two heads of this muscle and the hamstring muscles above, there is a lozenge shaped space through the middle of which run the great popliteal vessels and nerves, I do not mean to say that this space is empty with the exception of these for it is filled with fatty matter and covered in by the fascia surrounding the joint, abscesses sometimes form here and are always very hard to cure permanently. The artery may and is sometimes taken up in this space, but I have found the fatty matter or cellular tissue surrounding joints so liable to inflammation, which is communicated to the joints from continuity of structure, - that I always think it best to avoid them, and particularly this one. Between this muscle and the other large one below we find a small one, called the

## Plantaris

This has a small fleshy belly but the longest tendon in the body, running between the two gastrocnemii, This arises from the external condyle and Capsular ligament, and its long thin flat tendon runs between the muscles to the point at which they join, when it gets to the inner side of the tendo Achillis and is inserted with it upon the tub-erosity of the os calcis. The function of this muscle has been supposed to be that of drawing the Capsule out from between the bones and prevent its being pinched, but in fact the object of it is yet unknown. It has

sometimes been ruptured, and given way with an audible snap. and yet its loss has not been followed by a pinching of the capsule, or any other appreciable inconvenience; We next come to the third head of this triceps extensor muscle which is called gastrocnemius internus or

## Soleus

This muscle has its origin from the head of the fibula and for a short distance down this bone, - from the tibia by an oblique line running outward and upward and also from the posterior part of this bone down to very near the ankle joint, When the origin crosses from one bone to the other near the top of the leg it forms a little fleshy arch under which the vessels and nerves pass on their way down the leg. The tendon of this muscle is first formed upon its posterior or outer face, where it receives that of the other gastrocnemius, - from which it becomes rounded and condensed into that thick and powerful tendon which we know as the tendo achillis, and which is inserted into the tuberosity of the os calcis. In turning this down we occasionally find a small bursa between it and the end of the calcis where it is beveled off for the play of the tendon, This is the particular extensor mass of muscles by which progression is in great measure accomplished, and its power is inferred when we consider that a strong man with the addition to his weight of a very heavy load upon his shoulders, can raise himself upon his toes by the sole or almost sole action of these muscles. From the origin of one portion from the condyles it will be seen that it will have a tendency to bring the body into a stooping posture. And in consequence of this connexion with the femur too, it will have a great effect when fractures occurring at the lower portion of this bone, and must therefore always receive attention; Another small muscle exists here which it is necessary to notice, and which is analogous to the anconeus of the elbow joint, this is the

## Popliteus

so called in consequence of being placed in this popliteal space. It arises from the external condyle under the ~~posterior~~ Ext lateral ligament of the joint, and passes obliquely across the joint through the capsule, to be inserted in

the oblique ridge below the head of the tibia opposite the ~~muscle~~ origin of the Soleus, This muscle as we have before seen gets a strong aponeurotic covering from the part of the tendon of the semimembranosus muscle which you see here spread over it, we have here also another view of the two additional insertions of this muscle, The action of this popliteus is probably that of keeping the capsular ligament from between the bones, and also to aid slightly in flexing the leg, Before taking up the consideration of the deep se-ated layer we will take a glance at the sole of the foot so as to be prepared to trace them from out to their insertion Immediately beneath the plantar fascia we have a single muscle called the

## Flexor Brevis digitorum Pedis,

which arises from the anterior portion of the os calcis and from the surface of the plantar fascia, from whence it passes forward to be split like the flexor perforatus of the fingers and inserted into the base of the second phalanges upon which its action of flexion is exerted, Upon raising this muscle we have brought into view the tendons of those situated upon the back of the leg, and can see to what ad-vantage they must act from playing round the internal malleolus as a pulley, We now go the consideration of these muscles, and first to one upon the side of the tibia called the **Flexor Longus communis digitorum Pedis** perforans, This muscle arises from the inner posterior edge of the tibia all the way down this bone from its head, forming a tendon upon its inner side which passes under the annular ligament behind the internal malleolus and through a sinuosity in the os calcis until it gains the middle of the foot where it splits into four tendons, These proceed forwards to perforate those of the short flex-or and be inserted into the base of the last phalanx of the four smaller toes. The action of this muscle will of course be to flex the toes, but when the foot is placed flat so that these cannot be flexed, then the action will be to raise the heel in a degree, We come next to a much stronger muscle called the

## Flexor ~~Proprius~~ Longus Pollicis Pedis

This muscle arises from the lower two thirds or three fourths of the inner edge of the fibula, from the interosseous ligament, and from the deep seated intermuscular

fascia from which it forms a thick tendon to pass through behind the malleolus, through the sinuosity in the os calcis to be inserted into the first phalanx of the great toe, This tendon is surrounded by a synovial sheath as the rest are from the malleolus to the insertion, This is a very strong muscle as we might expect from the force which we can exert upon the large toe, yet we cannot flex this great toe without flexing to a degree the smaller ones, and this occurs from the fact that a very considerable slip of tendon passes across from this to the tendon of the common extensor of the small toes, We have beside these an additional flexor muscle of the toes upon the sole of the foot, this is called the massa carnea or

## Flexor accessorius.

This is a small fleshy layer originating from the anterior part of the os calcis, and being inserted into the common extensor of the toes as it runs obliquely to gain the middle of the sole, This appears to be intended to correct the obliquity of this tendon and to enable the toes to be flexed in a straight line We have also connected with the toes some little muscles which have been likened to earth worms, - analagous to those in the hand, and called also the

## Lumbricales

These are four in number and arise from the common flexor tendon, and are distributed one to each small toe to be inserted upon the sides of the bases of the first phalanx. Their action is similar to what we found it in the hand namely to flex the toes, - There is one other muscle upon the back part of the leg between those already mentioned to which we must now give attention, I mean the

## Tibialis Posticus

Before speaking of which however I would incidentally direct your attention to the anomalous course of the posterior tibial artery in this case, where it runs through the fibres of the flexor pollicis, This tibialis Posticus muscle arises from the anterior part of the head of the tibia and passes through the interosseous ligament by an opening in its upper part, it then gets its origin further from the posterior face of the interosseous ligament and from the upper part of both the tibia and fibula

from this extensive origin the muscle terminates in a tendon which passes behind the malleolus along with the tendon of the flexor of the toes, although each has its separate sheath of synovial membrane about it; after getting around the malleolus the tendons diverge as this one then runs to be inserted into the margin of the scaphoid bone; As the tendon of the muscle passes over the calcaneo ~~scaphoid~~ ligament, there is developed a small bursa to prevent friction, This muscle will act in accordance with the peroneus longus muscle in extending the foot and thus antagonise the tibialis anticus and will also tend to turn the toes inwards. In some cases of Club foot this muscle becomes so contracted as to bring the scaphoid bone back and inward and draw up the edge of the foot, in which case it becomes necessary to divide it before a cure can be established. Now as the tendon is covered down to its insertion by a bursal sheath which is very liable to become inflamed. I deem it not wise to divide it below the malleolus for fear of producing this effect, - and prefer to make the division at a point above where it enters this sheath. This is readily done by singling out the tendon with the fingers and then after passing a knife down until you feel the bone turn the handle outwards and cut up towards the skin, without dividing anything but the tendon, Any of the rest of these tendons may be cut at this point, by using the same method taking care to separate them carefully and single out the proper one which it is desired to divide, Upon the sole of the foot there are a number of small muscles which I shall now briefly call your attention to without going very minutely into their consideration as they are not of very great importance, The first of these is the one upon the inside of the foot called the

## Abductor Pollicis Pedis

These muscles most generally have their origin from the os calcis, or some of the ligaments connecting it to the surrounding bones, This one arises from the os calcis and the ligament connecting it to the scaphoid bone, from whence it dips down under the short flexor of the toes and is inserted by a strong tendon into the inner side of the base of the first phalanx of the great toe. Its action is that of abducting the toe and giving or presenting a large base of sustentation for the body, by widening the foot. As we found

upon the hand a short flexor of the thumb which was divided into two parts by the passage of the long flexor tendon through it, so have we here also a

## Biceps Flexor Brevis Pollicis Pedis.

This muscle has its origin chiefly from the ligaments which connect the the bones of the tarsus, as that of the hand from those of the carpus. after which it is divided into two heads, one of which is inserted on the inside with the abductor, by the intervention of a sesamoid bone, whilst on the other is inserted by the same means on the opposite side of the joint, Stretching across from the bases of the third fourth and second metatarsal bones we have another small muscle called from its function the

## Adductor Pollicis Pedis

This muscle is inserted by a strong tendon into the base of the first phalanx along with the internal head of the short flexor, Its action is to adduct or draw the great toe towards the others, or prevent its being separated too far, upon the opposite side of the foot there are also some small muscles which make the ~~outer~~ margin of the foot, first we have the

## Abductor Minimi digiti

Arising from the outer tuberosity of the os Calcis and inserted into the outer base of the first phalanx, to abduct the little toe or separate it from the rest and thus widen the base of sustentation as the other abductor, Then we have the

## Flexor Brevis Minimi digiti

arising from the os Cuboides, and inserted into the bones at the first joint of the little toe by their lower surface, where its action will tend to flex this toe Next we have stretched across the sole of the foot to prevent the separation of the bones to too great an extent, not only a band of ligamentous fibres, but also a small muscle called the

## Transversalis Pedis

This arises from the capsule of the first joints of the little toe and the one next it, and is inserted into the head of the metatarsal bone of the great toe, We then have some interosseal muscles seven in number which are of no great importance, and which you can study if you wish,

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cancellous
chmarpium